Repair Manual

Indirect-Fired Air Heater

Cub 200
Cub 300

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Foreword

Machines covered by this manual

Machine	Item Number	Machine	Item Number
Cub 200	0620204	Cub 300	0620233
Cub 200	0620262	—	—

Machine documentation

- Keep a copy of the Operator's Manual with the machine at all times.
- Use the separate Parts Book supplied with the machine to order replacement parts.
- If you are missing any of these documents, please contact Wacker Neuson Corporation to order a replacement or visit www.wackerneuson.com.
- When ordering parts or requesting service information, be prepared to provide the machine model number, item number, revision number, and serial number.

Expectations for information in this manual

- This manual provides information and procedures to safely operate and maintain the above Wacker Neuson model(s). For your own safety and to reduce the risk of injury, carefully read, understand, and observe all instructions described in this manual.
- Wacker Neuson Corporation expressly reserves the right to make technical modifications, even without notice, which improve the performance or safety standards of its machines.
- The information contained in this manual is based on machines manufactured up until the time of publication. Wacker Neuson Corporation reserves the right to change any portion of this information without notice.

Manufacturer's approval

This manual contains several references to *approved* parts, attachments, and modifications. The following definitions apply:

- **Approved parts or attachments** are those either manufactured or provided by Wacker Neuson.
- **Approved modifications** are those performed by an authorized Wacker Neuson service center according to written instructions published by Wacker Neuson.
- **Unapproved parts, attachments, and modifications** are those that do not meet the approved criteria.

Unapproved parts, attachments, or modifications may have the following consequences:

- Serious injury hazards to the operator and persons in the work area
- Permanent damage to the machine which will not be covered under warranty

Contact your Wacker Neuson dealer immediately if you have questions about approved or unapproved parts, attachments, or modifications.

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1 Safety Information

1.1 Signal Words Found in this Manual

This is the safety alert symbol. It is used to alert you to potential personal hazards.
- ▶ Obey all safety messages that follow this symbol.

DANGER
DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
- ▶ To avoid death or serious injury from this type of hazard, obey all safety messages that follow this signal word.

WARNING
WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
- ▶ To avoid possible death or serious injury from this type of hazard, obey all safety messages that follow this signal word.

CAUTION
CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
- ▶ To avoid possible minor or moderate injury from this type of hazard, obey all safety messages that follow this signal word.

NOTICE: Used without the safety alert symbol, NOTICE indicates a situation which, if not avoided, could result in property damage.

Note: *A Note contains additional information important to a procedure.*

1.2 Safety Guidelines for Operating the Machine

Operator training

Before operating the machine:

- Read and understand the operating instructions contained in all manuals delivered with the machine.
- Familiarize yourself with the location and proper use of all controls and safety devices.
- Contact Wacker Neuson Corporation for additional training if necessary.

When operating this machine:

- Do not allow improperly trained people to operate the machine. People operating the machine must be familiar with the potential risks and hazards associated with it.

Machine condition

Only operate the machine when:

- All safety devices and guards are in place and in working order.
- All controls operate correctly.
- The machine is set up correctly according to the instructions in the Operator's Manual.
- The machine is clean.
- The machine's labels are legible.

When operating the machine:

- Do not modify or defeat the safety devices.
- Do not use worn electrical cords.
- Do not use faulty fuel supplies.

Guidelines for operator

When operating the machine:

- Remain aware of the machine's moving parts. Keep hands, feet, and loose clothing away from the machine's moving parts.
- Wear protective clothing appropriate to the job site when operating the machine.
- Wear safety glasses.

When operating the machine:

- Do not operate a machine in need of repair.
- Do not smoke near the machine.

Work space

When operating the machine:

- Position the machine on a firm, noncombustible, level surface.
- Keep the area immediately surrounding and underneath the machine clean, neat, and free of debris and combustible materials.
- Keep the area above the machine clear of debris that could fall on the machine.
- Store the machine properly when it is not being used.
- Keep unauthorized personnel, children, and pets away from the machine.

When operating the machine:

- Do not connect ductwork between the exhaust outlet port and the supply air inlet port.
- Never operate the machine in areas that contain flammable objects, fuels, or products that produce flammable vapors.
- Do not position the electrical cords under the machine or over the top of the machine.

1.3 Safety Guidelines for Lifting the Machine

Lifting/ transporting the machine

When lifting/transporting the machine:

- Make sure all lifting devices are attached securely and have enough weight-bearing capacity to lift or hold the machine safely.
- Remain aware of the location of other people when lifting the machine.
- Only use the lifting points and tie-downs described in the Operator's Manual.
- Only use suitable transport vehicles with sufficient load-carrying capacity.

When lifting the machine:

- Never walk or stand under a suspended machine.
- Never climb, sit, or stand on the machine while lifting it or transporting it.

1.4 Safety Guidelines While Using Combustion Burners

When using the machine:

- Clean up any spilled fuel immediately.
- Replace the fuel tank cap after refueling the machine.
- Refill the fuel tank in a well-ventilated area.
- Shut down the generator, if equipped, when refueling.

When using the machine:

DANGER
Exhaust gas from the burner contains carbon monoxide, a deadly poison. Exposure to carbon monoxide can kill you in minutes.

- ▶ Never run the machine indoors or in an enclosed area unless the machine is vented properly.

- Do not fill or drain the fuel tank near an open flame or while the machine is running.
- Do not smoke when refueling the machine.

1.5 Safety Guidelines for Maintaining the Machine

Training

- Only trained personnel should troubleshoot or repair electrical problems occurring with the machine.

Cleaning

When cleaning and servicing the machine:

- Keep the area around the burner free of debris such as leaves, paper, cartons, etc.
- Keep the machine clean and labels legible.

When cleaning the machine:

- Do not clean the machine while it is running.
- Never use gasoline or other types of fuels or flammable solvents to clean parts. Fumes from fuels and solvents can become explosive.

Maintenance guidelines

When maintaining the machine:

- Keep the fuel lines in good condition and properly connected.
- Allow the burner to cool before maintaining the machine.
- Reinstall the safety devices and guards after repairs and maintenance.
- Keep all electrical cords away from heat, oil, vibrating surfaces, and sharp edges.
- Inspect all electrical cords before each use and replace damaged cords.

Replacing parts and labels

When maintaining the machine:

- Replace worn or damaged components.
- Use only spare parts recommended by Wacker Neuson Corporation.
- Replace all missing and hard-to-read labels.
- Replace or repair electrical components with components that are identical in rating and performance as the original component.

Accessories, safety devices and modifications

When using the machine:

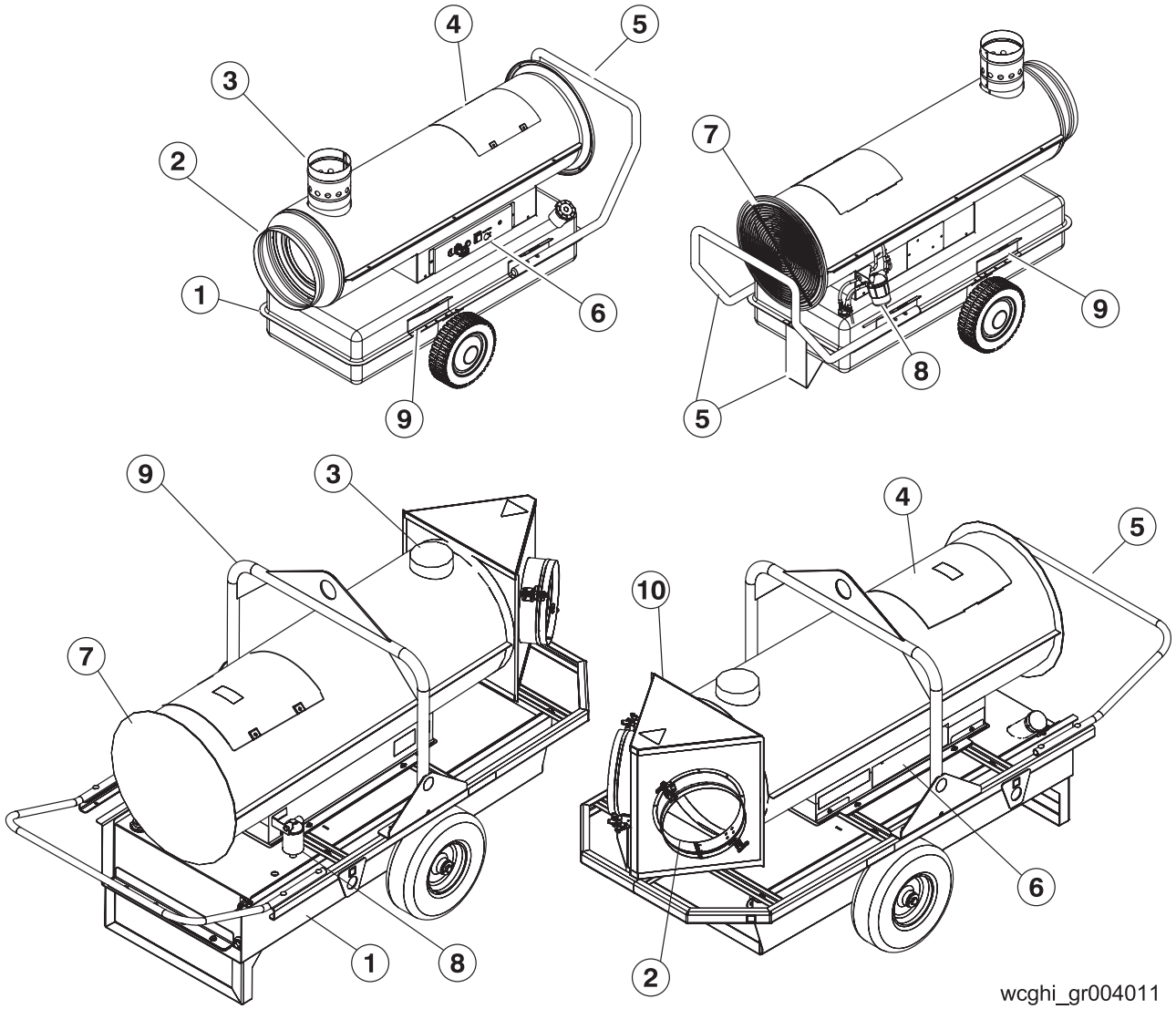
- Use only accessories/attachments that are recommended by Wacker Neuson Corporation.

When using the machine:

- Never operate the machine if any safety devices or guards are missing or inoperative.
- Do not defeat safety devices.
- Do not modify the machine without the express written approval of the manufacturer.

2 Operation

2.1 Controls and Components



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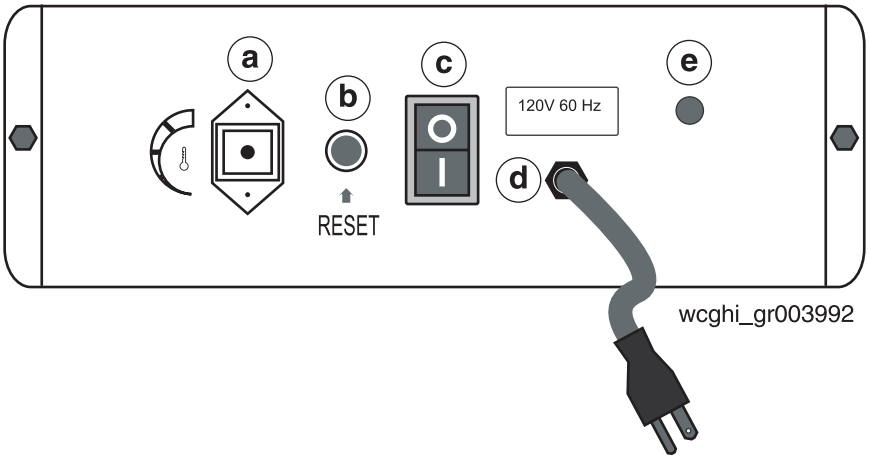
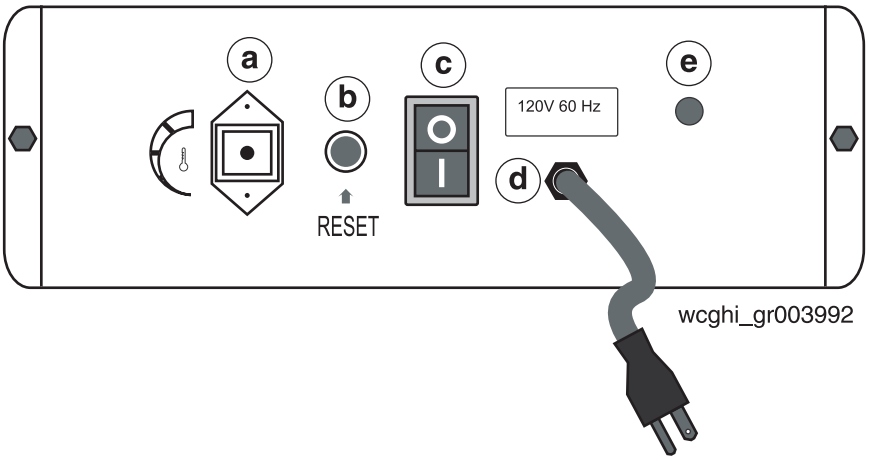
Ref	Component	Ref	Component
1	Fuel tank	2	Air outlet
3	Flue collar (vent)	4	Burner access panel
5	Handle (and base)	6	Control panel
7	Blower	8	Fuel oil filter
9	Lifting device	10	Duct adapter

2.2 Control Panel



Ref	Component	Function
a	Remote thermostat receptacle	The remote thermostat receptacle (shown with protective cap installed) is used for connecting an optional remote thermostat.
b	Burner fault lamp and reset button (dual function)	The dual function burner fault lamp and reset button: • illuminates red when the burner has faulted. • resets the machine when pressed.
c	Power switch	The power switch provides power to the machine.
d	Power cord	The power cord provides a means of connecting the machine to a 115V 60 Hz receptacle.
e	Power indicator lamp	The power indicator lamp illuminates green when the power cord is connected to a 115V 60 Hz receptacle.

2.3 Starting/Stopping the Machine



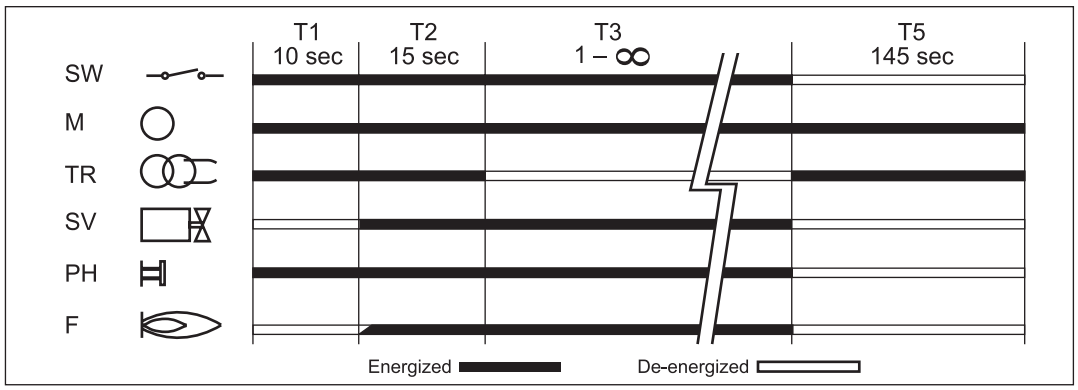
If not using the remote thermostat	
Turning ON	1. Move the power switch **(c)** to the ON “I” position. ▪ The blower will turn on immediately. ▪ The burner will go through a prepurge cycle and then ignite. ▪ The burner will continue to fire and the blower will continue to operate until the machine is turned off.
Turning OFF	2. Move the power switch to the OFF position. ▪ The burner will shut down. ▪ The blower will continue to operate for approximately two minutes to allow the combustion chamber to cool.

If using the remote thermostat	
Turning ON	1. Connect the remote thermostat to the control panel at the remote thermostat receptacle **(a)**.
	2. Place the remote thermostat in the area to be heated. Set it to the desired temperature.
	3. Move the power switch **(c)** to the ON “I” position. ▪ The blower will turn on immediately. ▪ The burner will go through a prepurge cycle and then light. ▪ The burner will continue to fire until the temperature of the space being heated reaches the temperature set by the thermostat. At that time, the burner shuts down but the blower will remain on.
Turning OFF	4. Move the power switch to the OFF position. ▪ The burner will shut down. ▪ The blower will continue to operate for approximately two minutes to allow the combustion chamber to cool.

Notes

3 Burner Setup

3.1 Control Board Sequence of Operation



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Periods

The burner controller has several periods it sequences through during normal operation. These periods are described below.

Period	Action or Function
Prepurge (T1)	As soon as the control switch (SW) is turned ON, the prepurge period begins. It lasts approximately 10 seconds. During this period: ■ The fan blows air into the combustion chamber to expel any residual exhaust gases. ■ The ignition transformer (TR) turns ON and remains ON. It produces a continuous spark across the electrodes so that any residual fuel is ignited and burned off. ■ The flame control unit (cad cell) (PH) checks for presence of a flame. If a consistent flame is detected, the ignition sequence is interrupted and the heater locks out.
Ignition (T2)	After the prepurge period, the ignition period begins. It lasts approximately 15 seconds. During this period: ■ The fan runs. ■ The ignition transformer (TR) is ON, producing a continuous spark across the electrodes. ■ The fuel solenoid (SV) opens and the fuel is ignited. The fuel solenoid will remain open if the cad cell (PH) detects a flame within 1 second from the start of this period. If no flame is detected, the fuel solenoid closes and the heater locks out.

Period	Action or Function
Operation (T3)	After the ignition period, the operation period begins. It will last as long as there is flame or until the heater is turned off. During this period: ■ The fan runs. ■ The ignition transformer (TR) is OFF. There is no spark across the electrodes. ■ The fuel solenoid (SV) is open and flame is self-sustaining. The cad cell (PH) monitors the flame. If the flame is interrupted through lack of fuel or lack of air, the machine will go through the prepurge and ignition period in an attempt to re-establish the flame. If the flame is not re-established, the aftercooling period begins.
Aftercooling (T5)	After the heater is turned OFF (or after flame re-establishment has failed), the aftercooling period begins. It lasts approximately 1 minute and 45 seconds. During this period: ■ The power switch is OFF. ■ The fan runs. After approximately 1 minute and 45 seconds, the fan stops. ■ The ignition transformer (TR) turns ON and remains ON. It produces a continuous spark across the electrodes so that any residual fuel is ignited and burned off.
Reset	To reset the heater: 1. Wait 30 seconds after the lockout condition has occurred. 2. Push the reset button.

3.2 Setting Up the Burner

Factory settings

Machine	Nozzle size	Fuel pressure		Air band setting
	gph	psi	bar	
Cub 200	1.0 x 60°A	175	12	2
Cub 300	1.5 x 80°W	175	12	3
Cub 300HD	1.35 x 80°H	218	15	5

Background

The burner consists of several different components and subsystems. Each of these components or subsystems must be operating correctly for the burner to function properly.

Fuel

Low ambient temperatures cause diesel fuels to gel. Gelled fuels will cause burner ignition failure and/or burner fuel pump damage. Always use the proper fuel for the conditions.

Fuel Blend Guide		
Lowest expected ambient temperature °F (°C)	**Generator powered**	**Shore powered**
Below 5 (-15)	50-50 blend of #2 diesel and #1 diesel, plus additives OR 50-50 blend #2 diesel and K1 kerosene, plus additives	100% #1 diesel plus additives OR 100% K1 kerosene, plus additives
5 to 25 (-15 to -4)	70-30 blend of #2 diesel and #1 diesel, plus additives OR 70-30 blend of #2 diesel and K1 kerosene, plus additives	
Above 25 (-4)	Winter-blend diesel	

Note: *The burner on this machine was calibrated by test-firing for correct operation at Wacker Neuson Corporation located 180 m (600 ft.) above sea level using #2 diesel fuel combined with an anti-gelling additive.*

Tools required

The following tools are required to adjust the burner:

- High-quality combustion analyzer
- Smoke spot tester
- Fuel pressure test gauge
- General hand tools

Mandates

- Adjustments made shall be done so that the machine conforms to the requirements of local, state, and federal codes and authorities.
- Adjustments shall be made at the job site.

This procedure continues on the next page.

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When

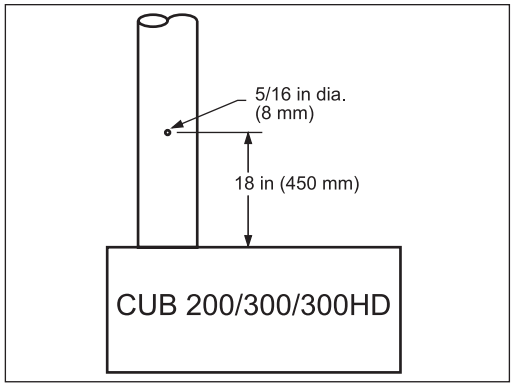
Adjust the burner:

- Before operating the machine at elevations 305 m (1,000 ft) above or below the location of where the last adjustments were made
- Before starting at a new job site
- After any burner maintenance or repair has been performed
- If burner performance is in question

Procedure

Follow the procedure below to set up the burner.

1. Shut down the machine.
2. Set the burner electrodes.
   (See Section 3.4 *Checking and Adjusting the Burner Electrodes* on page 22.)
3. Check the burner nozzle.
   (See Section 3.5 *Checking and Replacing the Burner Nozzle* on page 23.)
4. Set the air band.
   (See Section 3.6 *Setting the Air Band* on page 24.)
5. Start the machine and the burner.
6. Check/set the fuel pressure.
   (See Section 3.7 *Checking and Adjusting the Fuel Pressure* on page 25.)
7. Conduct a smoke spot test. Follow the smoke spot tester manufacturer's instructions and the general guidelines below.



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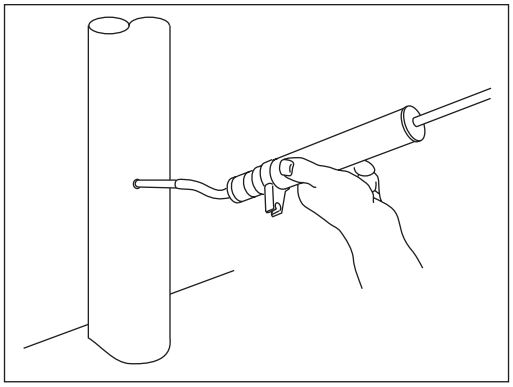

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- Use the access hole in the exhaust stack.
- Several samples should be taken as the heater warms.
- The final sample should be taken just before the heater reaches 71°C (160°F).

This procedure continues on the next page.

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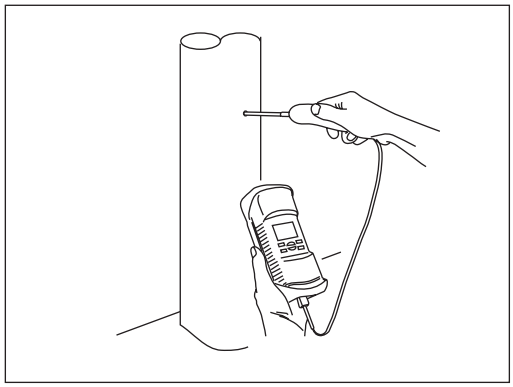
8. Analyze the combustion. Follow the combustion analyzer manufacturer's instructions and the general guidelines below.



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- Use the access hole in the exhaust stack.
- Take several samples as the heater warms.
- Take the final sample just before the heater reaches 71°C (160°F).

9. Re-adjust the air band, if necessary, until the smoke spot test and combustion analysis are within the following parameters:

- O_2 content: 3–5%
- Smoke spot: less than 1

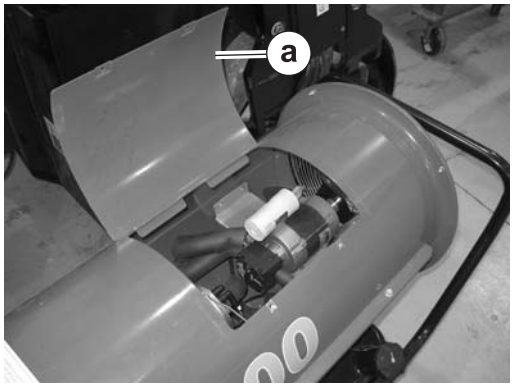
Result The burner has now been set.

3.3 Removing and Installing the Burner Assembly

Background Before performing any maintenance on the burner assembly, it must be removed from the machine.

Removal To remove or install the burner assembly perform the following procedure:

1. Shut down the machine and allow it to cool.
2. Disconnect the power cord from the power supply.
3. Remove the two bolts and open the access panel **(a)**.



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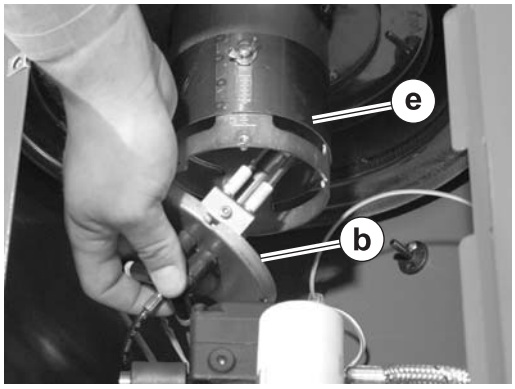

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4. Rotate the burner assembly **(b)** counterclockwise and remove it from the flame head and air tube assembly **(e)**.

Installation Perform the procedure below to install the burner assembly.

1. Place the burner assembly **(b)** into the flame head and air tube assembly **(e)**.
2. Rotate the burner assembly clockwise to lock it into place.
3. Close the access panel **(a)** and re-install the two bolts that secure it.

3.4 Checking and Adjusting the Burner Electrodes

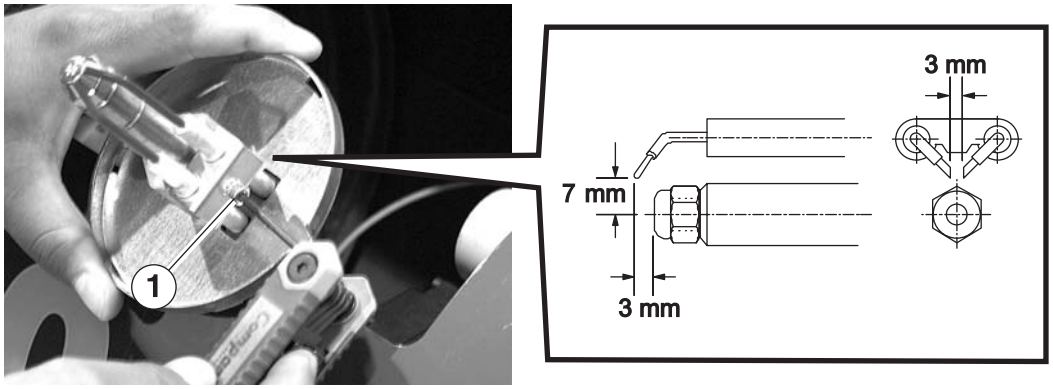
Requirements Burner assembly removed

Background Inspect the electrodes for the following:

- Wear
  Be sure to inspect the ends of the electrodes for pitting. Replace any worn electrodes.
- Straightness
  Replace any bent or broken electrodes.
- Cleanliness
  Clean the electrodes with a soft dry cloth or replace if necessary.
- Correct alignment
  Align the electrodes as shown.

Procedure Perform the procedure to replace or align the electrodes.

1. Remove the burner assembly from the machine.
2. Loosen the screw **(1)**.



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3. Align the electrode as shown or remove and install new electrodes if necessary.
4. Tighten the screw **(1)**.
5. Reinstall the burner.

Result The electrodes have now been adjusted.

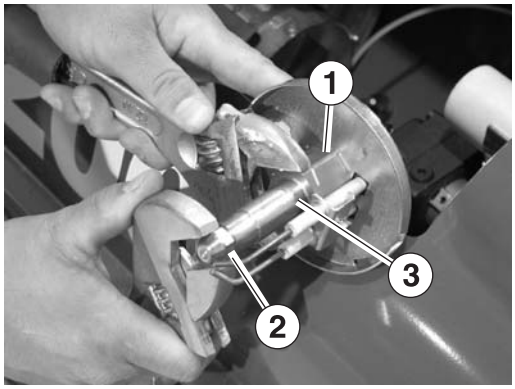
3.5 Checking and Replacing the Burner Nozzle

Requirements Burner assembly removed

Removal

Perform the procedure to remove the nozzle.

1. Remove the burner assembly. See topic *Removing and Installing the Burner Assembly*.
2. Place an adjustable wrench on the large fitting **(1)** on the nozzle base **(3)**.



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3. Place another adjustable wrench on the nozzle **(2)**.
4. Rotate the nozzle counter-clockwise and remove it from the assembly.

Installation

Perform the procedure to install the nozzle.

1. Install the new nozzle **(2)** onto the nozzle base **(3)**.
2. Tighten the nozzle **(2)** using an adjustable wrench. Rotate the wrench clockwise.
3. Reinstall the burner assembly.

Result The nozzle has now been replaced.

3.6 Setting the Air Band

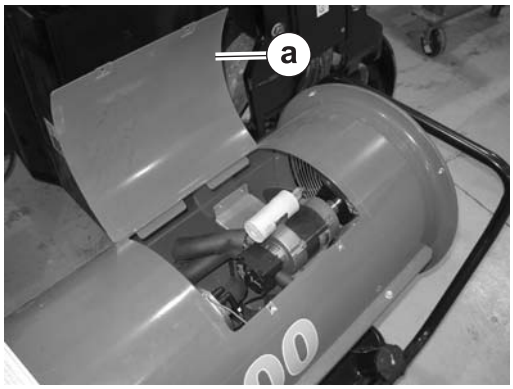
Requirements

- Machine shut down
- Power disconnected

Procedure

Perform the procedure below to set the air band.

1. Shut down the machine and allow it to cool.
2. Disconnect the power cord from the power source.
3. Remove the two bolts and open the access panel **(a)**.



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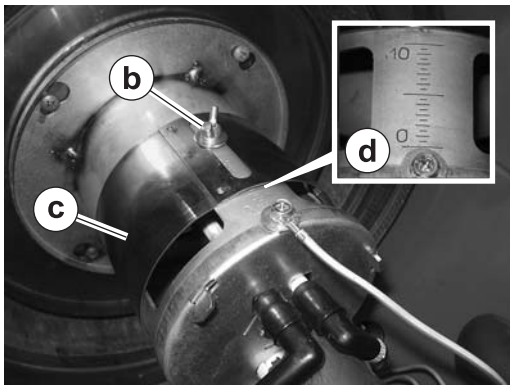

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4. Loosen the wing nut **(b)** and slide the air band **(c)** as needed. The front edge should line up with the graduations (markings) on the flame head **(d)**.
5. Tighten the wing nut.

Result

The air band has now been set.

3.7 Checking and Adjusting the Fuel Pressure

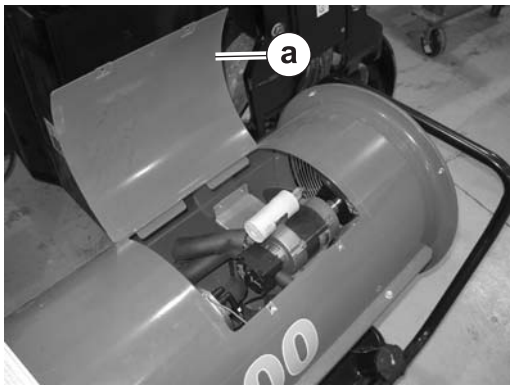
Requirements

- Pressure gauge
- British Parallel Thread (BPT) adapter

Procedure

To check and/or adjust the fuel pressure, carry out the following procedure:

1. Shut down the machine and allow it to cool.
2. Disconnect the power cord from the power source.
3. Open the access panel **(a)**.



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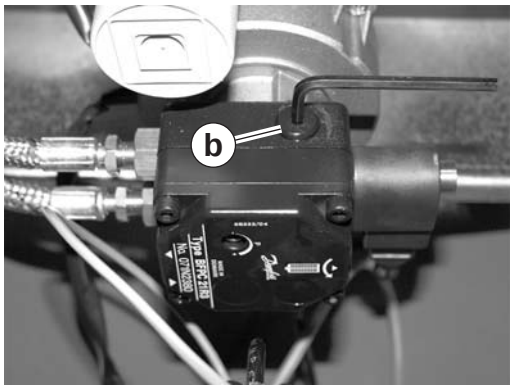

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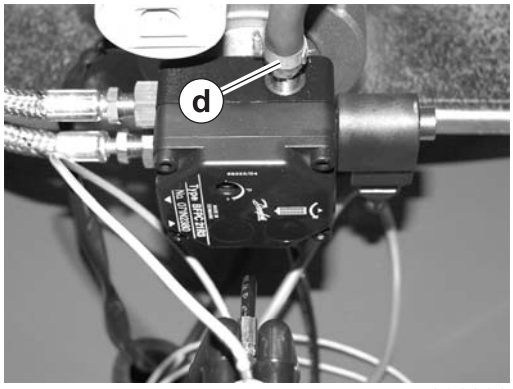
4. Remove the threaded plug **(b)** from the pressure test port using an allen wrench. Set the plug in a safe location to be re-installed later.
5. Install a pressure gauge with BPT adapter **(d)** in the pressure test port.



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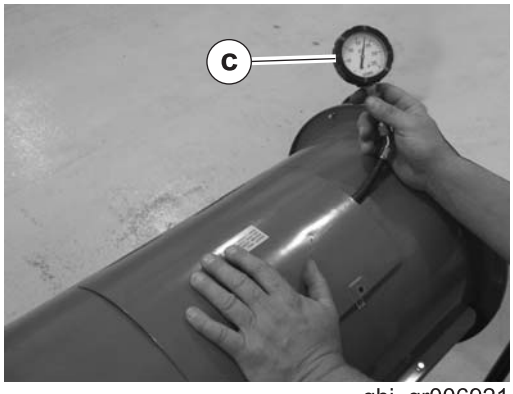

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6. Reconnect the power source.
7. Start the machine. With the machine running and access panel closed, observe the fuel pressure on the gauge **(c)**. For the correct pressure, refer to the *Technical Data* charts in this manual.
8. Shut down the machine.

This procedure continues on the next page.

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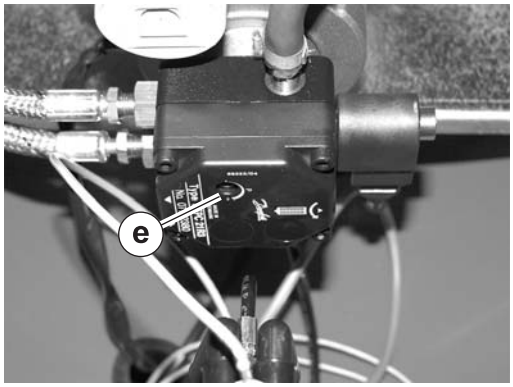
9. Adjust the fuel pressure, if necessary, using the adjusting screw **(e)**.



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NOTICE: Do not adjust the fuel pressure outside of the parameters listed in the *Technical Data* charts.

10. Restart the machine and check the gauge.

11. Repeat steps 7–9 as necessary until the pressure is correct.

12. Remove the pressure gauge **(d)** from the pressure test port.

13. Reinstall the threaded plug **(b)** into the pressure test port.

14. Close the access panel and reinstall the two bolts that secure it.

4 Troubleshooting Basics

Where to Begin

Procedure Perform the procedure below to determine where to begin.

1. Connect the power cord to a 120 VAC power supply.

2. Turn the machine on.

If	Then
The blower runs,	the problem is with the burner system. See Chapter 6 *Troubleshooting the Burner*.
The blower does not run,	the problem is with the blower system. See Chapter 5 *Troubleshooting the Blower.*
The motor hums,	the problem is with the starter capacitor. See Topic 5.4 *Checking the Capacitor.*

3. Turn the machine off.

5 Troubleshooting the Blower

Best practice

The best practice when troubleshooting this system is to:

1. Isolate and check each component of this system individually.
2. When a malfunctioning component is found, repair or replace it.
3. After replacing a malfunctioning component, retry system operation.

This chapter provides procedures to check the components.

Sequence

When troubleshooting the blower, do so in the following sequence.

Step	Task	See Topic
1.	Check the fuse.	5.1
2.	Check power to/from the control board.	5.2
3.	Check the ON-OFF switch.	5.3
4.	Check the capacitor.	5.4

WARNING

Electric shock hazard. Some tests require measuring live, high voltages. Electric shock can cause severe injury or death.

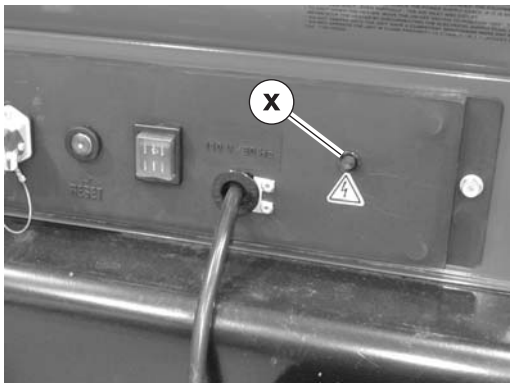
- ▶ Use extreme care and appropriate arc flash avoidance techniques when measuring live, high voltages.

5.1 Checking the Fuse

Requirements 120V power source

Procedure Perform the procedure below to check the fuse.

1. Connect the power cord to a 120 VAC power supply.
2. Observe the green light **(x)**.



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Does the green light illuminate?

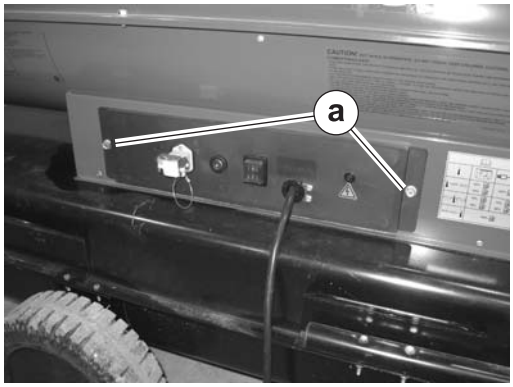
Yes ____	**No** ____
The fuse is OK.	Continue.

3. Disconnect the power cord from the electric power supply.

WARNING
Electric shock hazard. High voltage exists inside the control panel when the power cord is plugged into a power supply. Electric shock can cause serious injury or death.

- ▶ Disconnect the machine from the electric power supply before continuing this procedure.

4. Remove the screws that hold the control panel and pull the control panel from the machine.



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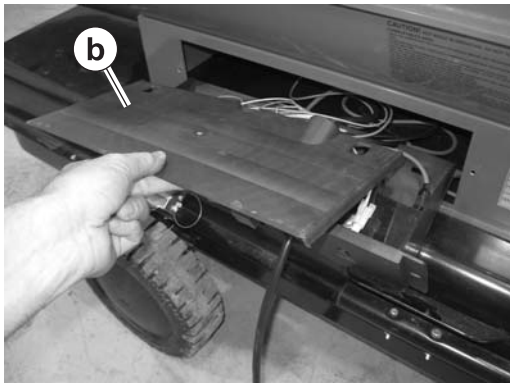
5. Remove the cover **(b)** from the control panel.



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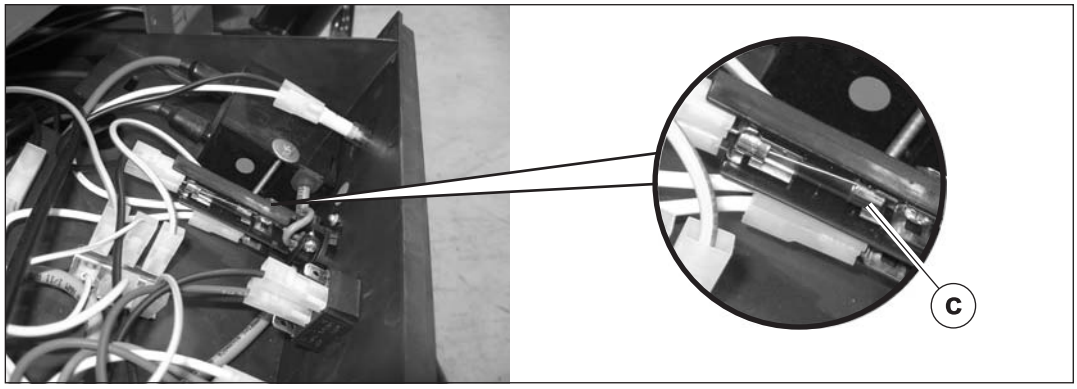
6. Locate the fuse **(c)** and check its condition.



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7. Replace the fuse if it is blown with a fuse of the same size and rating.

Result

The fuse has now been checked.
If the problem has not been resolved, leave the machine disassembled and continue with the next topic. Otherwise, reassemble the machine.

5.2 Checking Power to/from the Control Board

Requirements

- 120 VAC power source
- Multimeter
- Machine's fuse is OK

Procedure

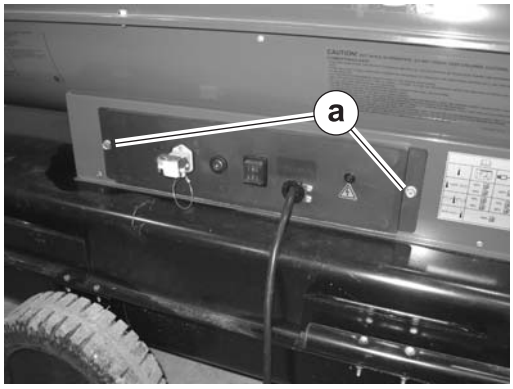
Perform the procedure below to check power to/from the control board.

WARNING

Electric shock hazard. High voltage exists inside the control panel when the power cord is plugged into a power supply. Electric shock can cause serious injury or death.

- ▶ Use extreme care and appropriate arc flash avoidance techniques when performing this procedure.

1. Remove the screws **(a)** that hold the control panel and pull the control panel from the machine.



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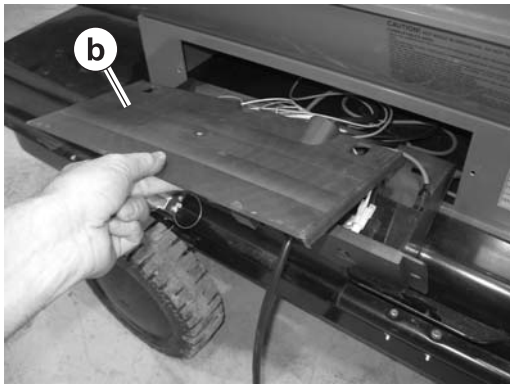

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2. Remove the cover **(b)** from the control panel.
3. Connect the power cord to a 120 VAC power supply.
4. Turn the machine on.

This procedure continues on the next page.

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5. Measure the voltage between terminal **M8** and terminal **M11** on the control board.

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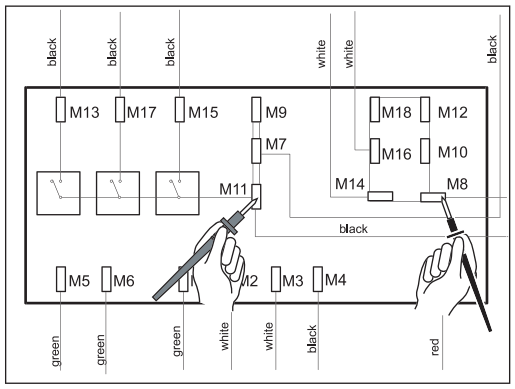

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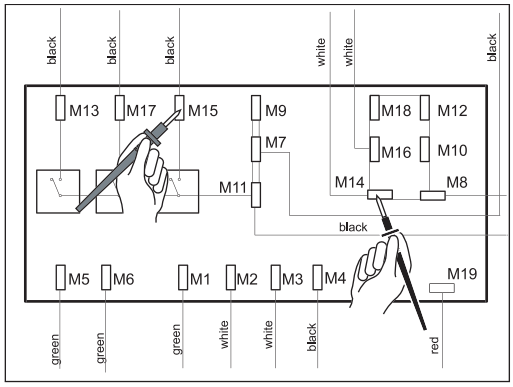
Is 108–132 VAC measured?

Yes ____	**No** ____
Continue.	Disconnect the power supply. Check the function of the ON-OFF switch and the wiring to the ON-OFF switch.

6. Measure the voltage between terminal **M15** and terminal **M14**.



ghi_gr006832

Is 108–132 VAC measured?

Yes ____	**No** ____
The power to and from the control board is OK.	The control board has failed. Disconnect the power supply and replace the control board.

Result

The power to and from the control board has now been checked.
If the problem has not been resolved, leave the machine disassembled and continue with the next topic. Otherwise, reassemble the machine.

5.3 Checking the ON-OFF Switch

Requirements

- Electric power disconnected from the machine
- Multimeter

Procedure

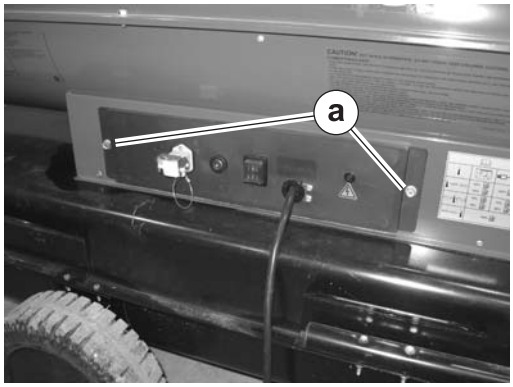
Perform the procedure below to check the ON-OFF switch.

1. Disconnect the power cord from the power supply.

WARNING
Electric shock hazard. High voltage exists inside the control panel when the power cord is plugged into a power supply. Electric shock can cause serious injury or death.

- ▶ Disconnect the machine from the power supply before continuing this procedure.

2. Remove the screws **(a)** that hold the control panel and pull the control panel from the machine.



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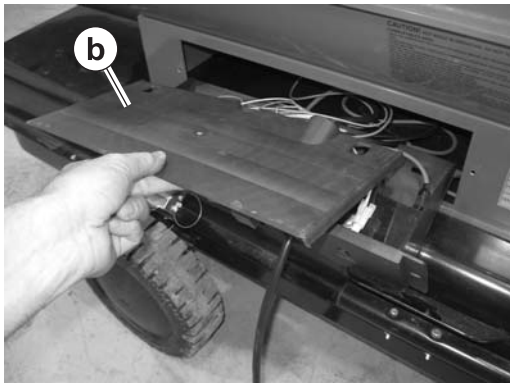

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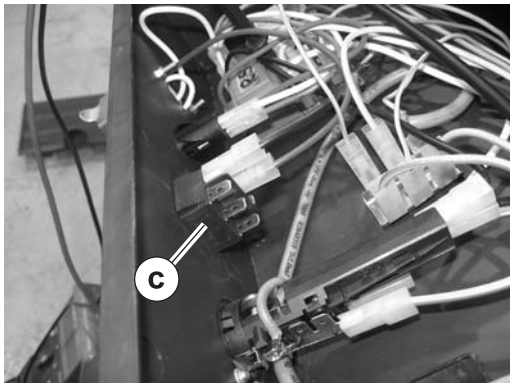
3. Remove the cover **(b)** from the control panel.

4. Locate the ON-OFF switch **(c)**.



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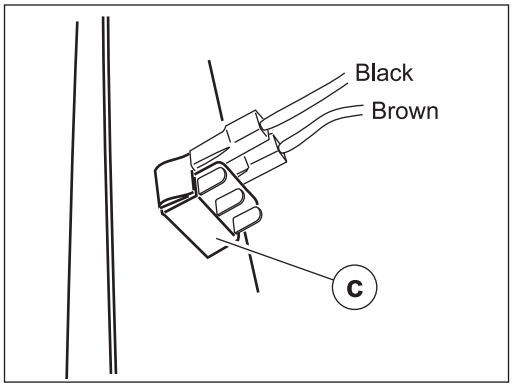

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5. Check the wiring to the ON-OFF switch. Make sure it is correct—black to upper terminal, brown to center terminal.

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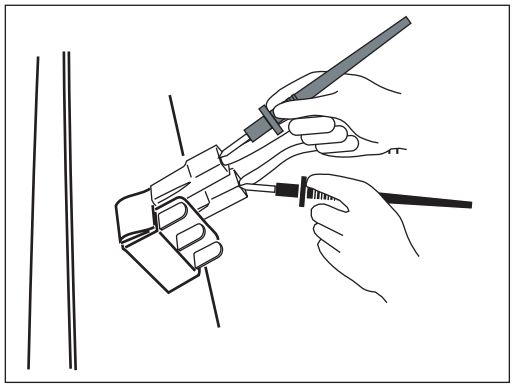
6. Check that there is continuity between the two terminals where the black and brown wires are connected. There should be continuity when in the ON position and no continuity in the OFF position.



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Does the ON-OFF switch perform as described above?

Yes ____	**No** ____
The ON-OFF switch is OK.	The ON-OFF switch has failed; replace it.

Result

The ON-OFF switch has now been checked.

If the problem has not been resolved, leave the machine disassembled and continue with the next topic. Otherwise, reassemble the machine.

5.4 Checking the Capacitor

Requirements

- Power disconnected
- Multimeter

Procedure

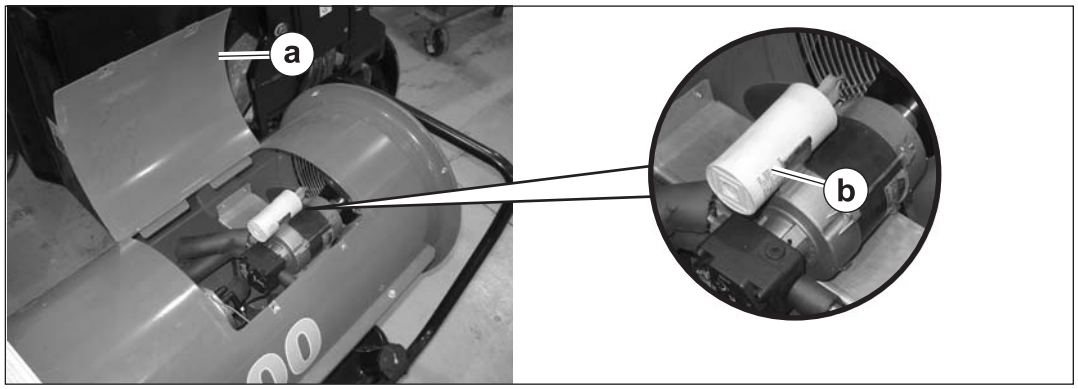
Perform the procedure below to check the capacitor.

1. Disconnect the power cord from the electric power supply.

WARNING
Electric shock hazard. High voltage exists inside the machine when the power cord is plugged into a power supply. Electric shock can cause serious injury or death.

▶ Disconnect the machine from the electric power supply before continuing this procedure.

2. Remove the access cover **(a)**.



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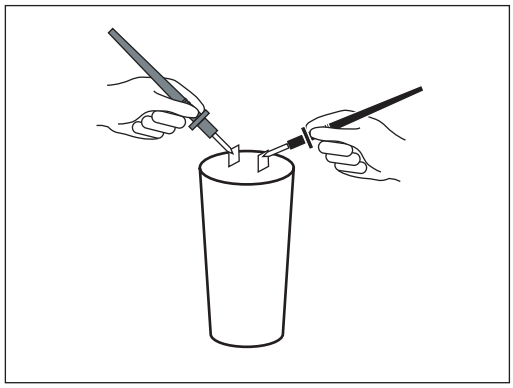
3. Disconnect the wiring from the capacitor **(b)** and remove the capacitor from the machine.

4. Discharge the capacitor by placing an insulated screwdriver across its two terminals.

5. Check the capacitance of the capacitor. It should measure 45–55 µF.



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Does the capacitor measure 45–55 µF?

Yes ____	**No** ____
Continue.	The capacitor has failed; replace it.

6. If the capacitor checks OK but the motor still hums, the problem is with the wiring from the motor to the capacitor. Check this wiring.

7. If the capacitor and the wiring check OK but the motor does not run, the motor has failed. Replace the motor.

Result The capacitor has now been checked. Reassemble the machine.

6 Troubleshooting the Burner

Background

The two sources of flame problems are:

- Fuel
- Ignition

Note: *Make sure the blower runs before troubleshooting burner problems. If the blower does not run, the burner will not fire. See topic Troubleshooting the Blower.*

Procedure

Perform the procedure below to determine if the problem is with the fuel system or with the ignition system.

1. Turn the machine on.

If	Then
There is a puff of smoke from the exhaust stack when the burner attempts to fire,	the problem is most likely with the fuel system. See **fuel problems** on the next page.
There is no puff of smoke from the exhaust stack when the burner attempts to fire,	the problem could be with the ignition system or the fuel system. Check both the ignition system and the fuel system. Start with diagnosing the ignition system. See **ignition problems** below.

2. Turn the machine off.

Ignition problems

For ignition system problems, check the following components in the sequence listed.

Order	Component	See topic
1.	Air band setting	3.6
2.	Electrodes	3.4
3.	Ignition transformer	6.1
4.	Cad cell	6.2

This procedure continues on the next page.

Continued from the previous page.

Fuel problems For fuel system problems, check the following items in the sequence listed.

Order	Component	See topic
1.	Fuel tank/supply	n/a
2.	Fuel filter	n/a
3.	Air band setting	3.6
3.	Fuel filter heater	6.3
4.	Fuel pressure	3.7

Depending on the results of the fuel pressure, continue with the appropriate sequence below.

If fuel pressure is OK:			If fuel pressure is low:		
Order	**Component**	**See topic**	**Order**	**Component**	**See topic**
1.	Check output voltage from the control board.	6.4	1.	Check the fuel lines.	6.9
2.	Check the air pressure switch.	6.5	2.	Check the fuel pump adapter.	6.10
3.	Check the fuel solenoid.	6.6			
4.	Check the flame head.	6.7			
5.	Check fuel flow from the nozzle.	6.8			

6.1 Checking the Ignition Transformer

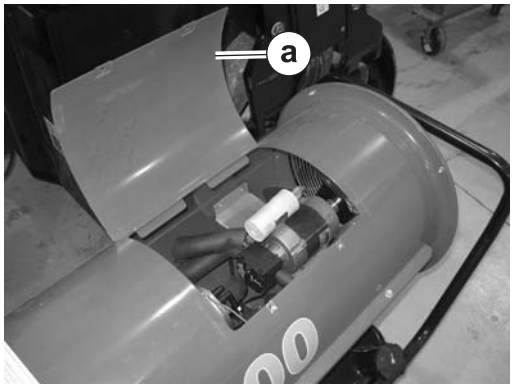
Requirements

- Fuel solenoid disconnected

Procedure

Perform the procedure below to check the ignition transformer.

1. Begin this procedure with the power supply disconnected.
2. Open the access panel **(a)**.



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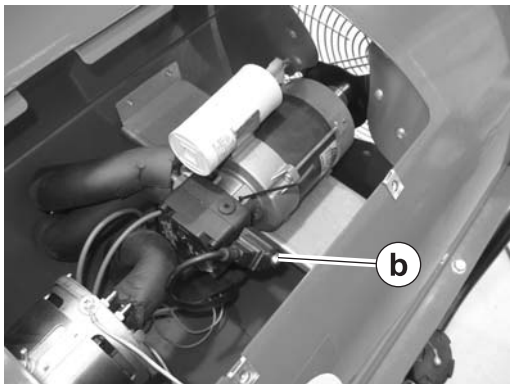

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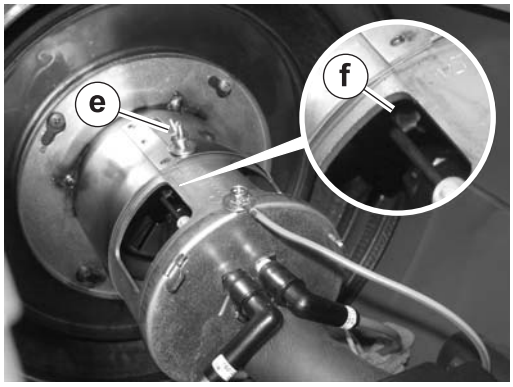
3. Locate the fuel solenoid **(b)** and disconnect it.
4. Loosen the wingnut **(e)** and open the air lock as far as possible.



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5. Connect the power supply.
6. Turn the machine on and observe the spark between the electrodes **(f)**.

Is a good, strong spark visible?

Yes ____	**No** ____
The ignition transformer is OK.	Continue.

This procedure continues on the next page.

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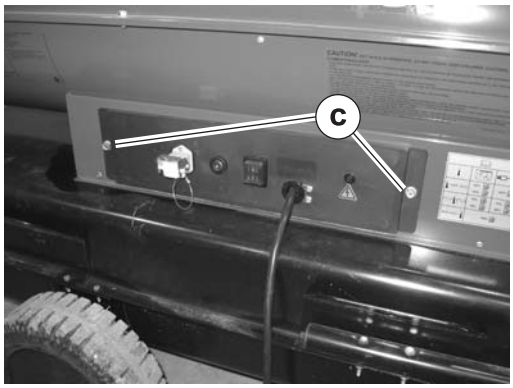
7. Turn the machine off.

8. Remove the screws **(c)** that hold the control panel and pull the control panel from the machine.



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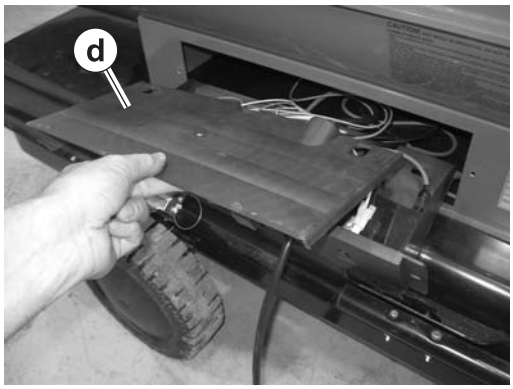

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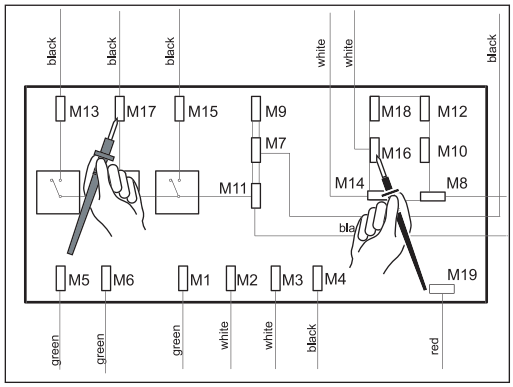
9. Remove the cover **(d)** from the control.

WARNING
Electric shock hazard. High voltage exists at the control panel when the machine is turned on. Electric shock can cause severe injury or death.

- Use extreme care and appropriate arc flash protective measures when working inside the machine.

10. Turn the machine on.

11. Measure the voltage at terminals **M17** and **M16**.



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Is 108–132 VAC measured?

Yes ____	No ____
Continue.	The control board has failed. Disconnect the power supply and replace the control board.

This procedure continues on the next page.

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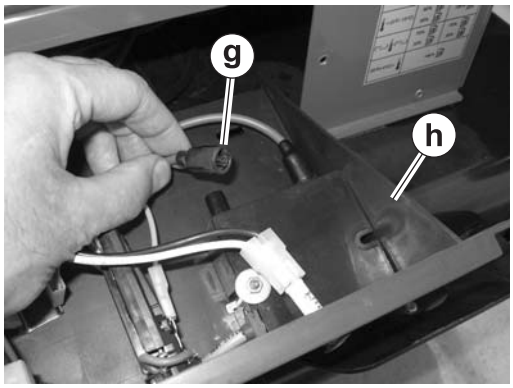
12.Turn the machine off.

13.Check the condition of the ignition wires **(g)** between the transformer **(h)** and the flame head **(i)**. If the ignition wires are damaged, replace them.



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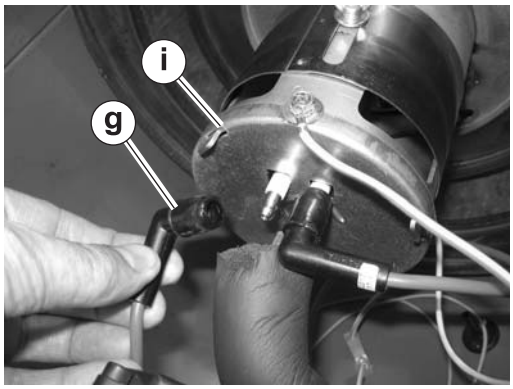

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14.Check the resistance of the ignition wires. They should measure approximately 1000 ohms. If the ignition wires measure OL, replace them.

Result

The procedure to check the ignition transformer is now complete. Reassemble the machine.

If the problem has not been resolved, leave the machine disassembled and continue with the next topic. Otherwise, reassemble the machine.

6.2 Checking the Cad Cell

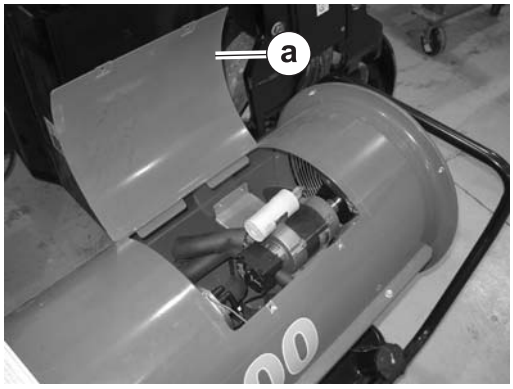
Requirements

- Power disconnected from the machine
- Multimeter

Procedure

Perform the procedure below to check the cad cell.

1. Disconnect the power cord from the power supply.
2. Open the access panel **(a)**.



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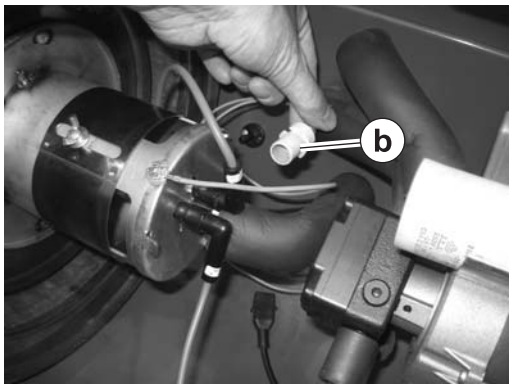

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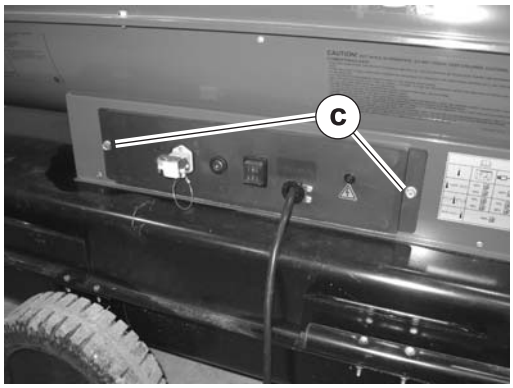
3. Twist and pull the cad cell **(b)** from the flame head.
4. Remove the screws **(c)** that hold the control panel and pull the control panel from the machine.



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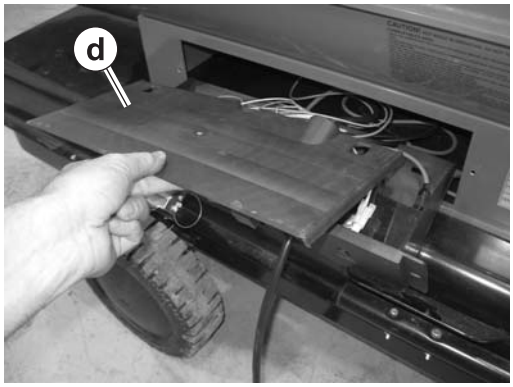

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5. Remove the cover **(d)** from the control panel.

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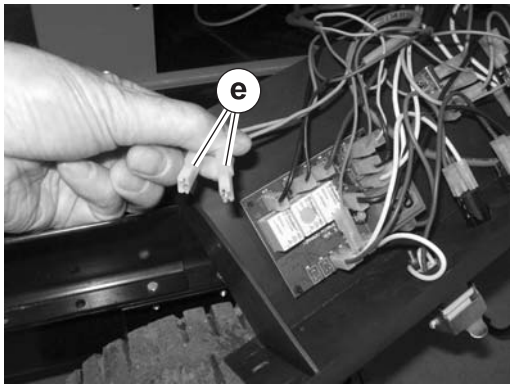
6. Disconnect the light green wires **(e)** from terminals M5 and M6 of the burner controller.



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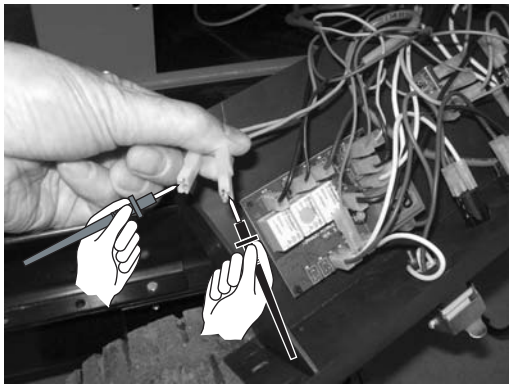


ghi_gr006989

7. Measure the resistance of the cad cell by measuring across the light green wires. Be sure the cad cell is exposed to light.

Note: *The resistance value will vary depending on the amount of light the cad cell receives.*

Is 1000–5000 ohms measured?

Yes ____	**No** ____
Continue.	The cad cell is dirty or defective. First, clean the cad cell with alcohol, then re-measure the resistance. If the reading remains out of the range listed above, replace the cad cell.

8. Deprive the cad cell of light (cover the cad cell) and measure the resistance again.

Note: *With the cad cell covered, a much higher resistance should be measured. Again, the amount will vary depending on the amount of light the cad cell receives.*

Is 20,000–80,000+ ohms measured?

Yes ____	**No** ____
The cad cell is OK.	The cad cell is dirty or defective. First, clean the cad cell with alcohol, then re-measure the resistance. If the reading remains out of the range listed above, replace the cad cell.

Result The procedure to check the cad cell is now complete. Reconnect the cad cell.

6.3 Checking the Fuel Filter Heater

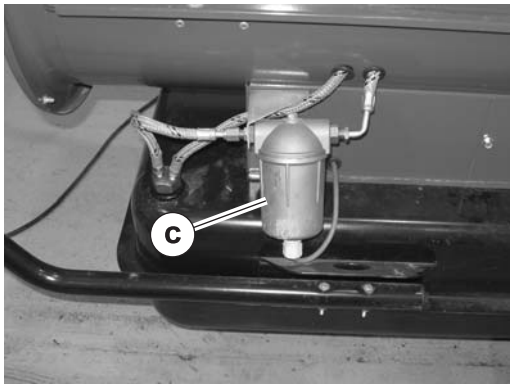
Requirements

- Multimeter
- Electric power disconnected from the machine

Procedure

Perform the procedure below to check the fuel filter heater.

1. Turn on the machine.
2. Wait 10–15 minutes, then feel the outside of the fuel filter canister **(c)**.

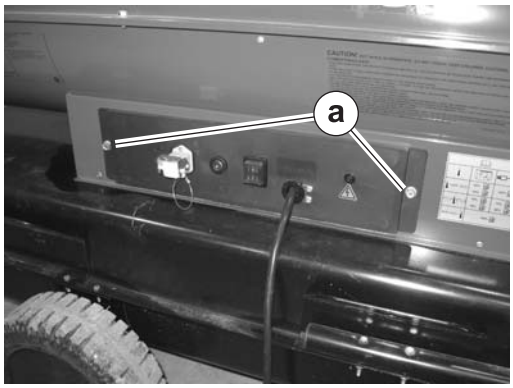


ghi_gr007017

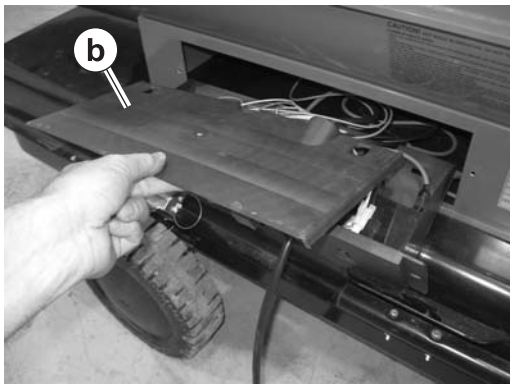
Is the fuel filter canister warm to the touch?

Yes ____	**No** ____
The fuel filter heater is working. No further testing is needed.	Continue.

3. Disconnect the power cord from the power supply.
4. Remove the screws **(a)** that hold the control panel and pull the control panel from the machine.



ghi_gr006825



ghi_gr006826

5. Remove the cover **(b)** from the control panel.

This procedure continues on the next page.

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6. Check that the fuel heater is connected to terminals M7 and M12 of the control board.

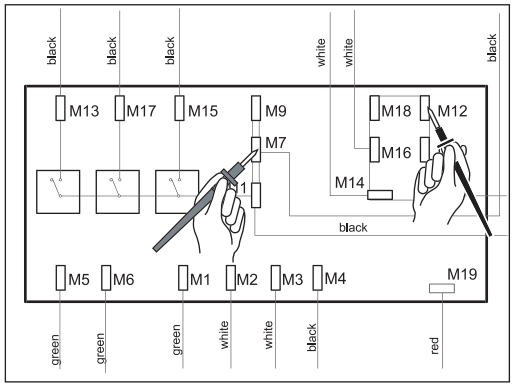
WARNING
Electric shock hazard. High voltage exists inside the control panel when the power cord is plugged into a power supply. Electric shock can cause serious injury or death.

- Use extreme care and appropriate arc flash avoidance techniques when performing this procedure.

7. Connect the power cord to the power supply.

8. Turn on the machine.

9. Measure the voltage between terminals **M7** and **M12** of the control board.



ghi_gr007016

Is 108–132 VAC measured?

Yes ____	No ____
The fuel filter heater has failed. Disconnect the power supply and replace the fuel filter heater.	The control board has failed. Disconnect the power supply and replace the control board. Recheck the fuel filter heater after the new control board is installed.

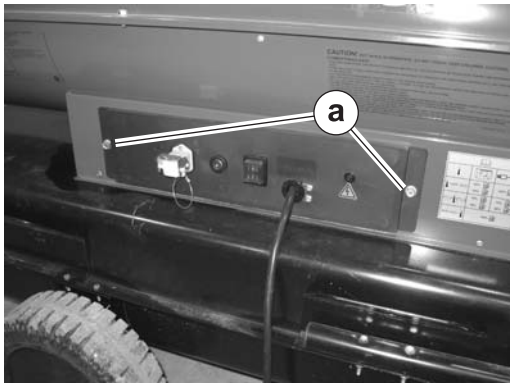
Result The fuel filter heater has now been checked. Reassemble the machine.

6.4 Checking Output Voltage from the Control Board

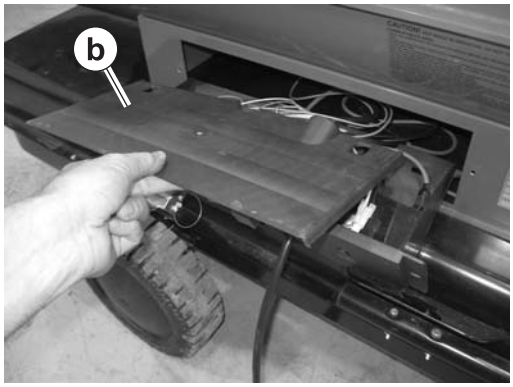
Requirements Multimeter

Procedure Perform the procedure below to check output voltage from the control board for the fuel system.

1. Start this procedure with the machine disconnected from the power supply.
2. Remove the screws **(a)** that hold the control panel and pull the control panel from the machine.



ghi_gr006825



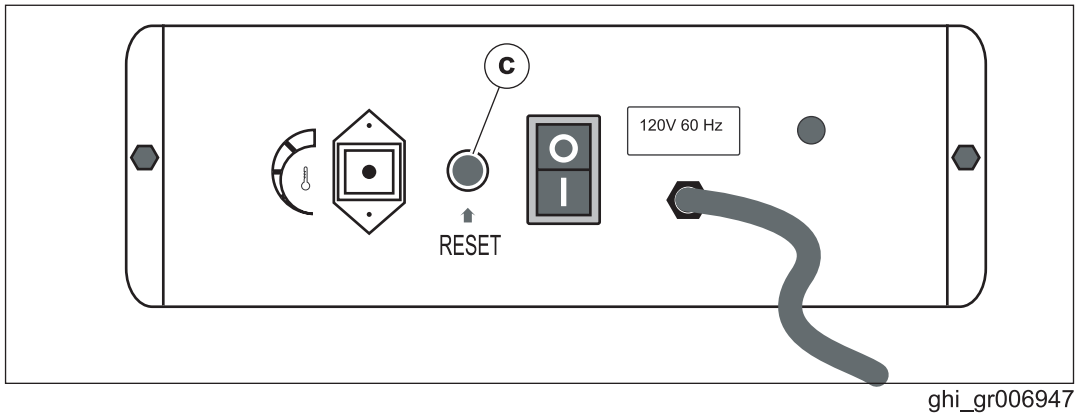
ghi_gr006826

3. Remove the cover **(b)** from the control panel.

WARNING
Electric shock hazard. High voltage exists inside the control panel when the power cord is plugged into a power supply. Electric shock can cause serious injury or death.

- Use extreme care and appropriate arc flash avoidance techniques when measuring live, high voltage.

4. Connect the machine to the power source.
5. Turn the machine on. If the machine is in a fault condition, press the RESET **(c)** button on the control panel.



ghi_gr006947

This procedure continues on the next page.

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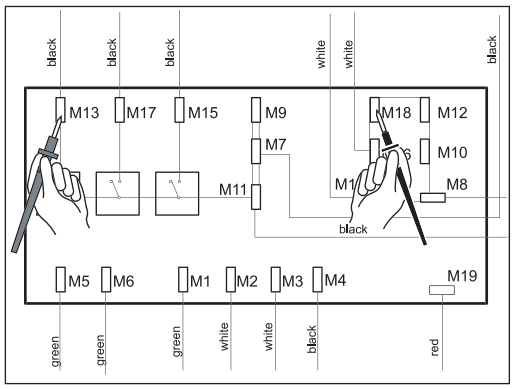
6. Measure the voltage between terminal **M13** and terminal **M18**. To do so, you must wait through the 10-second prepurge cycle.

Note: *The voltage will only be present for approximately 1 second if the flame is not established. In such a case, the machine will go into a fault condition. It may take more than one attempt to measure the voltage.*



ghi_gr006927

Is 108–132 VAC measured?

Yes ____	**No** ____
The outgoing power from the control board is OK.	The control board has failed. Disconnect the power supply and replace the control board.

7. Turn the machine off.

Result

The output voltage from the control panel has now been checked.

If the problem has not been resolved, leave the machine disassembled and continue with the next topic. Otherwise, reassemble the machine.

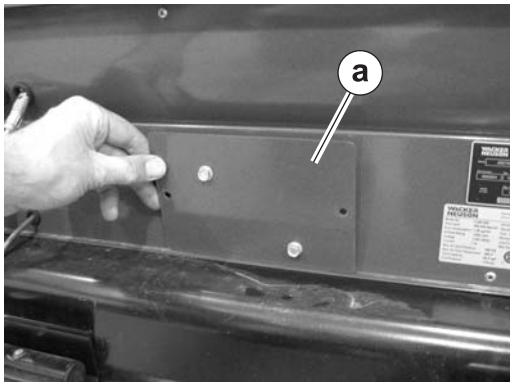
6.5 Checking the Air Pressure Switch

Requirements Multimeter

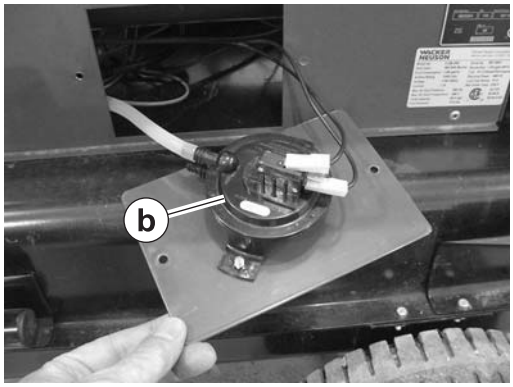
Procedure Perform the procedure below to check the air pressure switch.

1. Start this procedure with the machine disconnected from the power supply.

2. Remove the side access panel **(a)** from the machine.



ghi_gr006929



ghi_gr006930

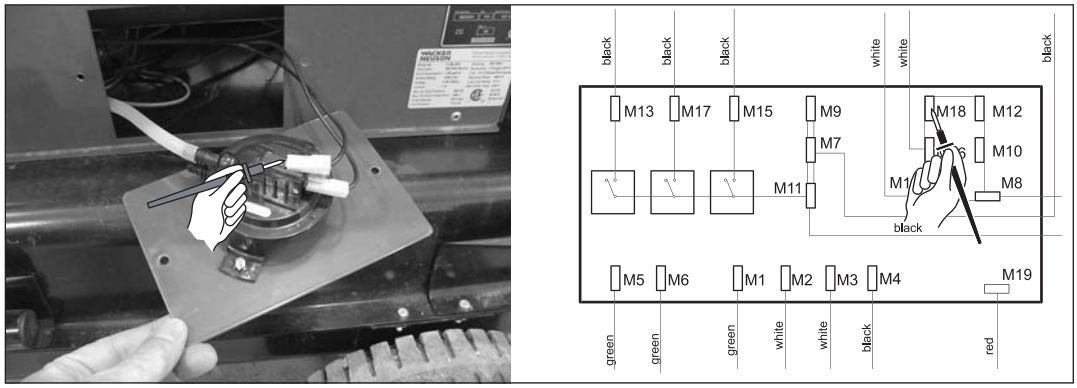
3. Locate the air pressure switch **(b)** and check the air hose for binding, pinching, or damage.

WARNING
Electric shock hazard. High voltage exists inside the control panel when the power cord is plugged into a power supply. Electric shock can cause serious injury or death.

- Use extreme care and appropriate arc flash avoidance techniques when measuring live, high voltage.

4. Connect the machine to the power source.

5. Turn the machine on and wait 10 seconds, then measure the voltage between the air pressure switch and terminal **M18** of the control board.



ghi_gr006928

This procedure continues on the next page.

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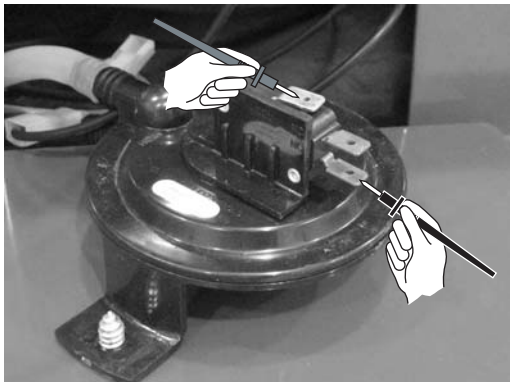
Is 108–132 VAC measured?

Yes ____	No ____
Continue.	The wiring between the control board and the air pressure switch has failed. Shut down the machine and check this wiring.

6. Turn the machine off.

7. Disconnect the wiring from the air pressure switch.

8. With the machine off, check the continuity between the terminals of the air pressure switch as shown.

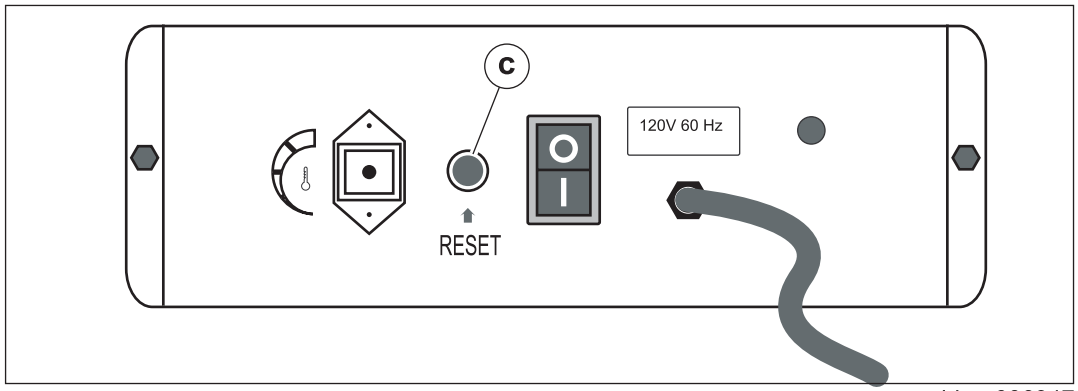


ghi_gr006931

Is there continuity?

Yes ____	No ____
The air pressure switch has failed; replace it.	Continue.

9. Turn the machine on. If the machine is in a fault condition, press the RESET **(c)** button on the control panel.



ghi_gr006947

This procedure continues on the next page.

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10. With the machine on, check the continuity between the same terminals of the air pressure switch.

Is there continuity?

Yes ____	No ____
The air pressure switch is OK.	The air pressure switch has failed. Shut down the machine and replace the air pressure switch.

11. Turn the machine off.

12. Reinstall the wires.

Result

The air pressure switch has now been checked.

If the problem has not been resolved, leave the machine disassembled and continue with the next topic. Otherwise, reassemble the machine.

6.6 Checking the Fuel Solenoid

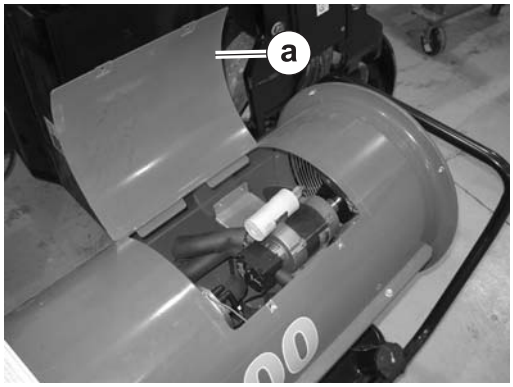
Requirements

- Multimeter
- Air pressure switch checks OK

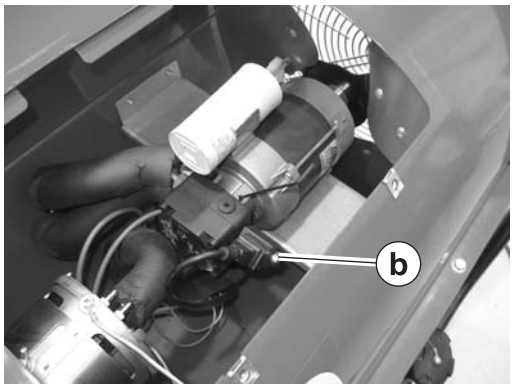
Procedure

Perform the procedure below to check the fuel solenoid.

1. Turn the machine off.
2. Open the access panel **(a)**.



ghi_gr006918



ghi_gr006923

3. Locate the fuel solenoid **(b)** and disconnect it.

WARNING
Electric shock hazard. High voltage exists at the fuel solenoid and other components inside the machine when the machine is turned on.

- ▶ Use extreme care and appropriate arc flash protective measures when working inside the machine.

This procedure continues on the next page.

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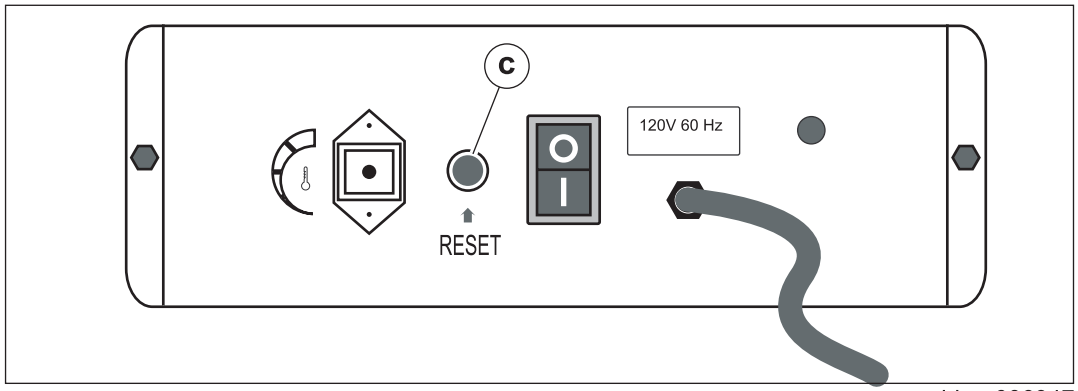
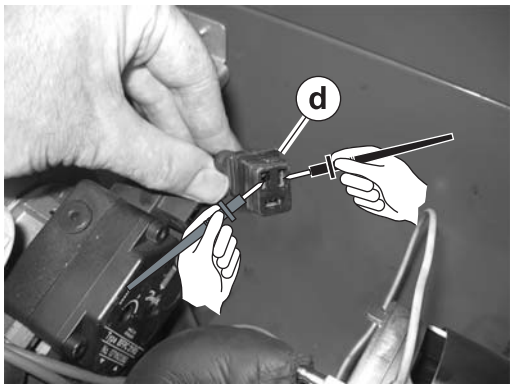
4. Turn the machine on. If the machine is in a fault condition, press the RESET **(c)** button on the control panel.



ghi_gr006947

5. Measure the voltage at the connector **(d)**. To do so, you must wait through the 10-second prepurge cycle.

Note: *The voltage will only be present for approximately 1 second after the prepurge cycle ends. It may take more than one attempt to measure the voltage.*



ghi_gr006924

Is 108–132 VAC measured?

6. Turn the machine off and disconnect the power source.

Yes ____	**No** ____
Continue.	The wiring to the fuel solenoid has failed. Shut down the machine and repair this wiring.

This procedure continues on the next page.

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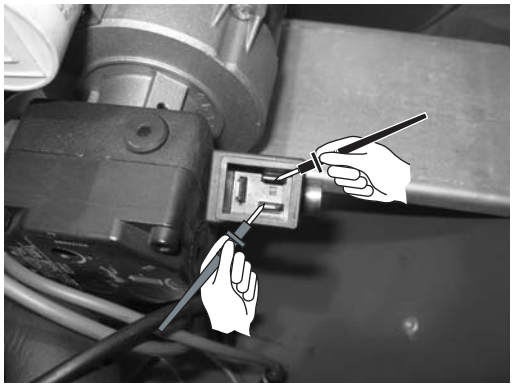
7. Measure the resistance across the coil of the solenoid as shown.



ghi_gr006932

Is 600–700 ohms measured?

Yes _____	**No** _____
The fuel solenoid is OK.	The fuel solenoid has failed; replace it.

Result

The fuel solenoid has now been checked.

If the problem has not been resolved, leave the machine disassembled and continue with the next topic. Otherwise, reassemble the machine.

6.7 Checking the Flame Head

Requirements

- Power disconnected
- Hand tools

Procedure

Perform the procedure below to check the flame head.

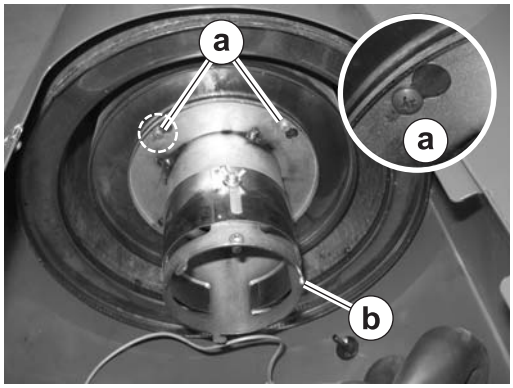
1. Disconnect the power cord from the power supply.

WARNING
Electric shock hazard. High voltage exists inside the machine when the power cord is plugged into a power supply. Electric shock can cause serious injury or death.

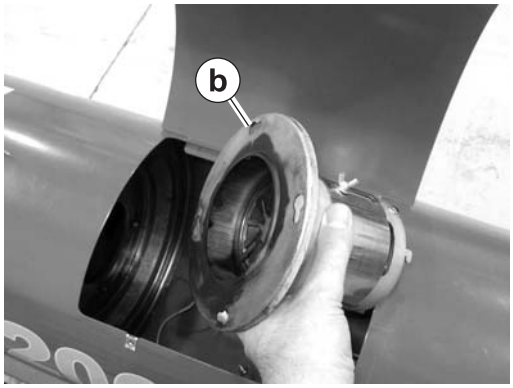
▶ Disconnect the machine from the electric power supply before continuing this procedure.

2. Remove the burner assembly. See topic *Removing/Installing the Burner Assembly*.

3. Loosen the four screws **(a)**.



ghi_gr006936



ghi_gr006937

4. Turn the flame head **(b)** counterclockwise and pull it from the machine.

5. Clean the flame head if it is dirty or full of soot.

6. Replace the flame head if it is damaged.

Result

The flame head has now been checked.

If the problem has not been resolved, continue with the next topic.

6.8 Checking the Fuel Flow from the Nozzle

Requirements Container to catch fuel (5 gallon bucket)

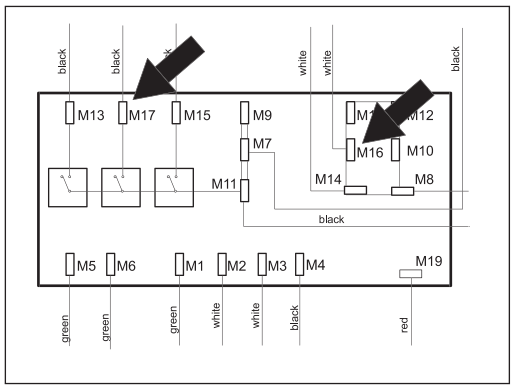
Procedure Perform the procedure below to check the fuel flow from the nozzle.

1. Disconnect the power cord from the power supply.

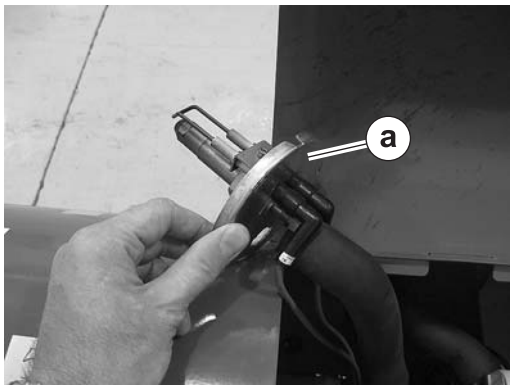
WARNING
Electric shock hazard. High voltage exists inside the machine when the power cord is plugged into a power supply. Electric shock can cause serious injury or death.

- ▶ Disconnect the machine from the electric power supply before continuing this procedure.

2. Disarm the ignition function of the control board by removing the wires from terminals **M16** and **M17**.



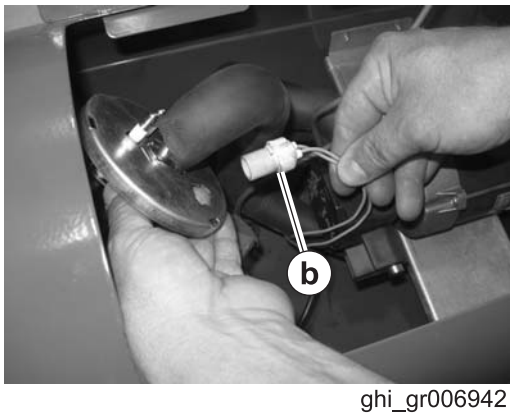
ghi_gr006938



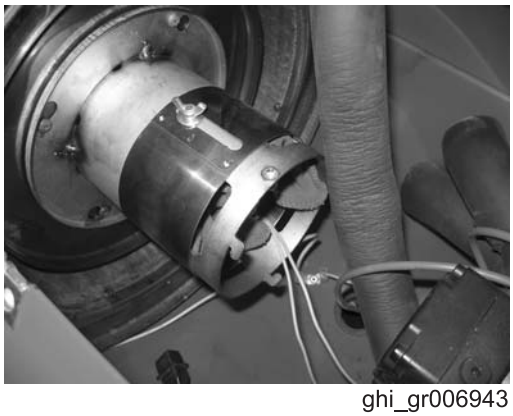
ghi_gr006939

3. Remove the nozzle assembly **(a)** from the flame head.

4. Remove the cad cell **(b)**.



ghi_gr006942


ghi_gr006943

5. Place the cad cell inside the flame head and cover it with a rag.

This procedure continues on the next page.

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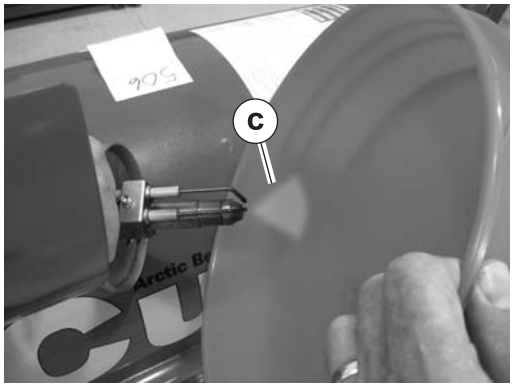
6. Connect the machine to the power supply.

WARNING
Fire hazard. The fuel may ignite if there is an ignition source nearby. Fire can cause severe injury or death.

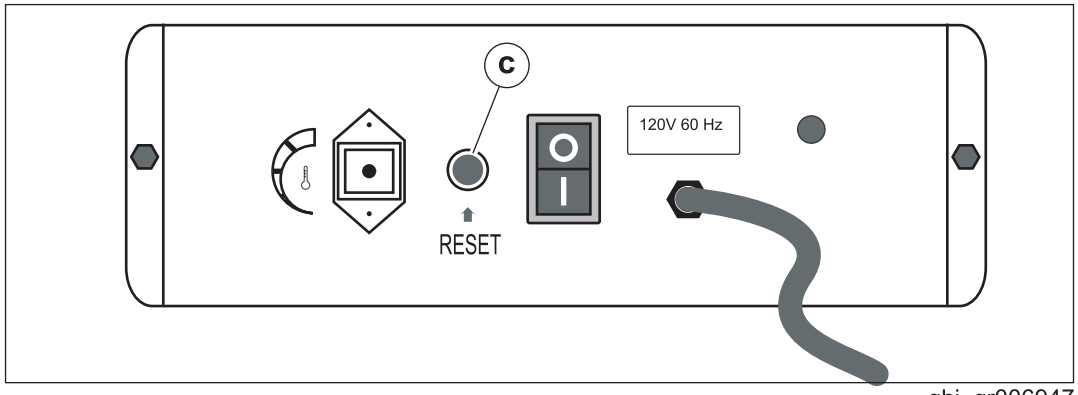
- ▶ Continue this procedure only when all sources of ignition have been removed from the proximity of the machine.

7. Hold the nozzle assembly facing into a container to catch the fuel spray.



ghi_gr006940

8. Turn the machine on. If the machine is in a fault condition, press the RESET **(d)** button on the control panel.



ghi_gr006947

9. After the 10-second prepurge cycle, the nozzle will spray fuel for approximately 1 second. Observe the spray pattern **(c)**.

Does the fuel spray form a consistent cone pattern?

Yes ____	**No** ____
The nozzle is OK.	The nozzle is dirty or damaged. Clean or replace the nozzle.

Result

The nozzle now been checked. Reassemble the machine.

If the problem has not been resolved, continue with the next topic.

6.9 Checking the Fuel Lines

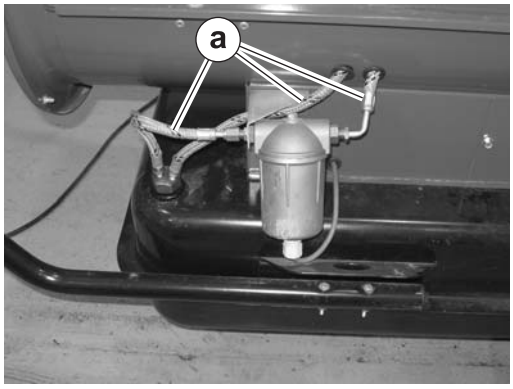
Requirements

- Machine turned off
- Power supply disconnected

Procedure

Perform the following procedure to check the fuel lines.

1. Turn the machine off.
2. Inspect the fuel lines **(a)** for leakage and loose fittings.



ghi_gr006944

3. Repair or replace the fuel lines as needed.

Result

The fuel lines have now been checked.

If the problem has not been resolved, continue with the next topic.

6.10 Checking the Fuel Pump Adapter

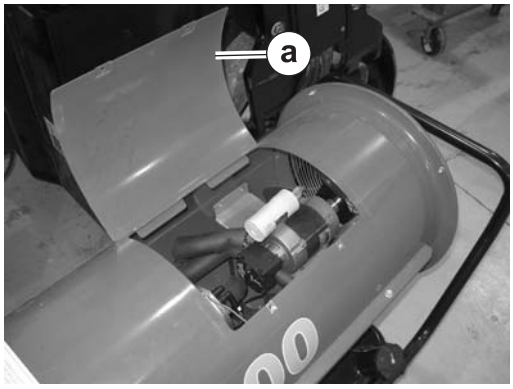
Requirements

- Machine turned off
- Power supply disconnected

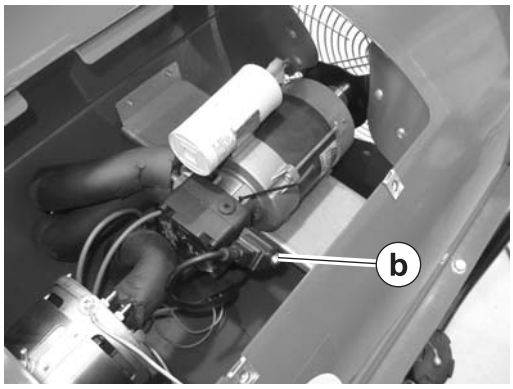
Procedure

Perform the following procedure to check the fuel pump adapter.

1. Turn the machine off.
2. Open the access panel **(a)**.

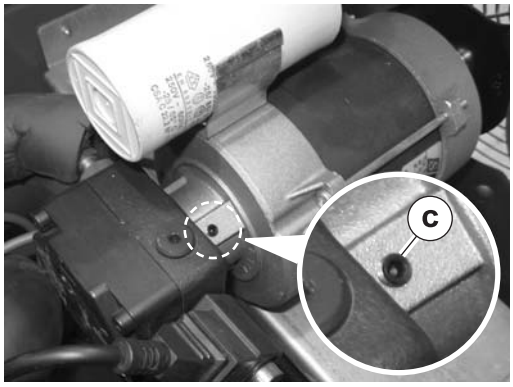


ghi_gr006918

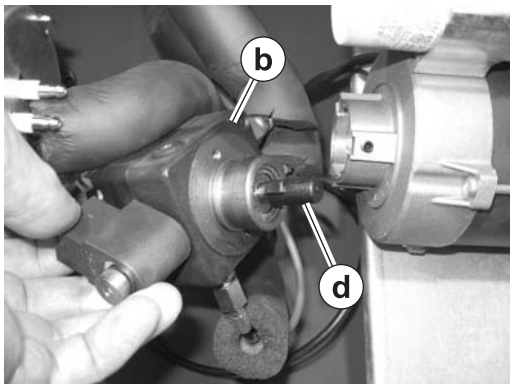


ghi_gr006923

3. Locate the fuel pump **(b)**.
4. Loosen the three set screws **(c)**.



ghi_gr006946



ghi_gr006945

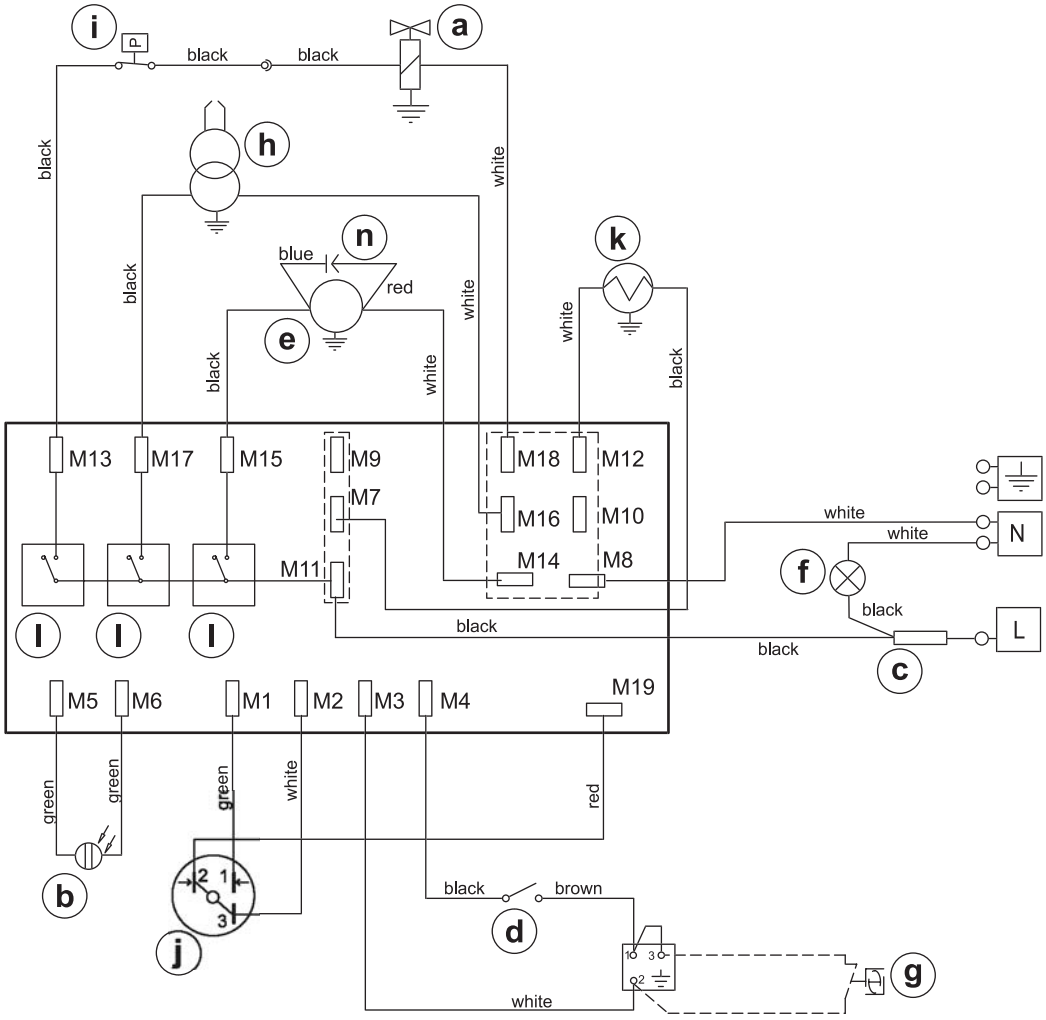
5. Remove the fuel pump **(b)** from the motor.
6. Check the fuel pump adapter **(d)** and replace the fuel pump adapter if it is damaged.

Result

The fuel pump adapter has now been checked. Reassemble the machine.

7 Schematic

7.1 Cub 200/Cub 300 Schematic



Threadlockers and Sealants

Threadlocking adhesives and sealants are specified throughout this manual by a notation of “S” plus a number (S#) and should be used where indicated. Threadlocking compounds normally break down at temperatures above 175°C (350°F). If a screw or bolt is hard to remove, heat it using a small propane torch to break down the sealant. When applying sealants, follow instructions on container. The sealants listed are recommended for use on Wacker Neuson equipment.

TYPE ( ) = Europe	COLOR	USAGE	PART NO. – SIZE
Loctite 222 Hernon 420 Omnifit 1150 (50M)	Purple	Low strength, for locking threads smaller than 6 mm (1/4”). Hand tool removable. Temp. range: -54 to 149°C (-65 to 300°F)	73287 - 10 ml
Loctite 243 Hernon 423 Omnifit 1350 (100M)	Blue	Medium strength, for locking threads larger than 6 mm (1/4”). Hand tool removable. Temp. range: -54 to 149°C (-65 to 300°F)	29311 - .5 ml 17380 - 50 ml
Loctite 271/277 Hernon 427 Omnifit 1550 (220M)	Red	High strength, for all threads up to 25 mm (1”). Heat parts before disassembly. Temp. range: -54 to 149°C (-65 to 300°F)	29312 - .5 ml 26685 - 10 ml 73285 - 50 ml
Loctite 290 Hernon 431 Omnifit 1710 (230LL)	Green	Medium to high strength, for locking preassembled threads and for sealing weld porosity (wicking). Gaps up to 0.13 mm (0.005”) Temp. range: -54 to 149°C (-65 to 300°F)	28824 - .5 ml 25316 - 10 ml
Loctite 609 Hernon 822 Omnifit 1730 (230L)	Green	Medium strength retaining compound for slip or press fit of shafts, bearings, gears, pulleys, etc. Gaps up to 0.13 mm (0.005”) Temp. range: -54 to 149°C (-65 to 300°F)	29314 - .5 ml
Loctite 545 Hernon 947 Omnifit 1150 (50M)	Brown	Hydraulic sealant Temp. range: -54 to 149°C (-65 to 300°F)	79356 - 50 ml
Loctite 592 Hernon 920 Omnifit 790	White	Pipe sealant with Teflon for moderate pressures. Temp. range: -54 to 149°C (-65 to 300°F)	26695 - 6 ml 73289 - 50 ml
Loctite 515 Hernon 910 Omnifit 10	Purple	Form-in-place gasket for flexible joints. Fills gaps up to 1.3 mm (0.05”) Temp. range: -54 to 149°C (-65 to 300°F)	70735 - 50 ml

Threadlockers and Sealants

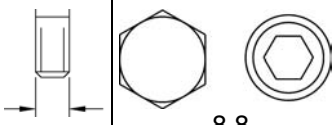
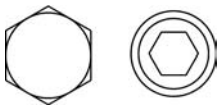
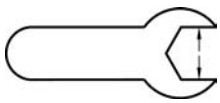
Threadlockers and Sealants (continued)

Threadlocking adhesives and sealants are specified throughout this manual by a notation of “S” plus a number (S#) and should be used where indicated. Threadlocking compounds normally break down at temperatures above 175°C (350°F). If a screw or bolt is hard to remove, heat it using a small propane torch to break down the sealant. When applying sealants, follow instructions on container. The sealants listed are recommended for use on Wacker Neuson equipment.

TYPE ( ) = Europe	COLOR	USAGE	PART NO. – SIZE
Loctite 496 Hernon 110 Omnifit Sicomet 7000	Clear	Instant adhesive for bonding rubber, metal and plastics; general purpose. For gaps up to 0.15 mm (0.006”) Read caution instructions before using. Temp. range: -54 to 82°C (-65 to 180°F)	52676 - 1oz.
Loctite Primer T Hernon Primer 10 Omnifit VC Activator	Aerosol Spray	Fast curing primer for threadlocking, retaining and sealing compounds. Must be used with stainless steel hardware. Recommended for use with gasket sealants.	2006124-6 oz.

Torque Values

Metric Fasteners (DIN)

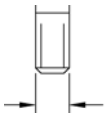
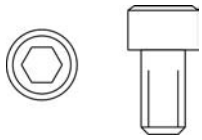
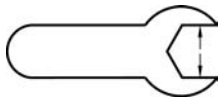
	TORQUE VALUES (Based on Bolt Size and Hardness)						**WRENCH SIZE**			
	 8.8		 10.9		12.9					
Size	**Nm**	**ft.lb.**	**Nm**	**ft.lb.**	**Nm**	**ft.lb.**	**Metric**	**Inch**	**Metric**	**Inch**
M3	1.2	*11	1.6	*14	2.1	*19	5.5	7/32	2.5	–
M4	2.9	*26	4.1	*36	4.9	*43	7	9/32	3	–
M5	6.0	*53	8.5	6	10	7	8	5/16	4	–
M6	10	7	14	10	17	13	10	–	5	–
M8	25	18	35	26	41	30	13	1/2	6	–
M10	49	36	69	51	83	61	17	11/16	8	–
M12	86	63	120	88	145	107	19	3/4	10	–
M14	135	99	190	140	230	169	22	7/8	12	–
M16	210	155	295	217	355	262	24	15/16	14	–
M18	290	214	405	298	485	357	27	1-1/16	14	–
M20	410	302	580	427	690	508	30	1-1/4	17	–

1 ft.lb. = 1.357 Nm * = in.lb. 1 inch = 25.4 mm

Torque Values

Torque Values (continued)

Inch Fasteners (SAE)

										
Size	**Nm**	**ft.lb.**	**Nm**	**ft.lb.**	**Nm**	**ft.lb.**	**Metric**	**Inch**	**Metric**	**Inch**
No.4	0.7	*6	1.0	*14	1.4	*12	5.5	1/4	–	3/32
No.6	1.4	*12	1.9	*17	2.4	*21	8	5/16	–	7/64
No.8	2.5	*22	3.5	*31	4.7	*42	9	11/32	–	9/64
No.10	3.6	*32	5.1	*45	6.8	*60	–	3/8	–	5/32
1/4	8.1	6	12	9	16	12	–	7/16	–	3/32
5/16	18	13	26	19	33	24	13	1/2	–	1/4
3/8	31	23	45	33	58	43	–	9/16	–	5/16
7/16	50	37	71	52	94	69	16	5/8	–	3/8
1/2	77	57	109	80	142	105	19	3/4	–	3/8
9/16	111	82	156	115	214	158	–	13/16	–	–
5/8	152	112	216	159	265	195	24	15/16	–	1/2
3/4	271	200	383	282	479	353	–	1-1/8	–	5/8

1 ft.lb. = 1.357 Nm * = in.lb. 1 inch = 25.4 mm